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Physics Abstracts

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PHYSICS ABSTRACTS

Volume 60 DECEMBER 1957 Number 720

MATHEMATICS 51

512.94

9488. MODEL TO ILLUSTRATE SOME PROPERTIES OF VECTORS IN THREE DIMENSIONS. A.V.Baez.
Amer. J. Phys., Vol. 25, No. 6, 380-1 (Sept., 1957).

Vectors represented by thin rubber tubing may be used to illustrate the polygon rule for vector addition in three dimensions. The elastic model lends itself to illustrate multiplication by a scalar, the difference between vectors, a displacement vector which varies with time and the fact that the time derivative of a displacement vector is tangent to the trajectory even when it is not a plane curve. A.

518.5 : 539.172.4

9489. ANALOG COMPUTATION IN NUCLEAR ENGINEERING. S.O.Johnson and J.N.Grace.
Nucleonics, Vol. 15, No. 5, 72-5 (May, 1957).

The development of the dynamic analogue computer for solving the behaviour of nuclear reactors in real time is outlined. Comparatively simple computers can be used to solve the variation of power level as a function of applied reactivity provided that the power is so low that reactivity feedback may be neglected. By including equations relating heat transfer and coolant circulation, a reactor simulator may be built. It can then be used to study the reactor transients resulting from various malfunctions of the plant. The accuracy of the analogue computer is discussed and its advantages and disadvantages compared with those of digital computers. R.D.Smith

518.5 : 539.172.4

9490. THE ROLE OF DIGITAL COMPUTERS IN NUCLEAR DESIGN. W.C.Sangren.
Nucleonics, Vol. 15, No. 5, 56-60 (May, 1957).

Calculations suitable for solution by digital computers are classified and the advantages of various types of machines considered. R.D.Smith

518.5 : 539.172.4

9491. CONTROL ANALYSIS WITH A DIGITAL COMPUTER. P.R.Hill and W.T.Lee.
Nucleonics, Vol. 15, No. 5, 61-3 (May, 1957).

The analysis of the control of the Martin power reactor has been carried out using both digital and analogue computers. The use of the I.B.M. 704 to solve the equations representing the kinetic behaviour is outlined and it is concluded that digital computers have some advantages over analogue computers for this type of problem. R.D.Smith

518.5 : 539.172.4

9492. DYNAMIC SIMULATION OF A FAST REACTOR. R.G.Olson.
Nucleonics, Vol. 15, No. 5, 76-9 (May, 1957).

Seventeen simultaneous equations were set up to describe the behaviour of the Enrico Fermi fast breeder reactor. These equations relate the fission heat generated in the core and blanket to the externally variable excess multiplication factor, to the temperature and temperature coefficients of reactivity of the core and blanket and coolant. Using an analogue computer, solutions were obtained for a linear increase of reactivity and for coolant-flow decay consequent on pump failure. The results show that the average fuel temperature remains well below melting point, though there may be some melting in the centres of some fuel pins. The temperature coefficients of the blanket and top structure contribute substantially to limiting the power excursion in increasing power accidents, but in decreasing power accidents they have little effect. R.D.Smith

518.5 : 539.172.4

9493. ANALOG STUDY OF BOILER–REACTOR INTERACTION. E.F.Borner and B.F.Cassidy.
Nucleonics, Vol. 15, No. 5, 84-8 (May, 1957).

The exact solution of the problem involves partial differential equations describing the distributed heat transfer. Approximate solutions for the stability of the reactor power were obtained on an analogue computer and the results from two different models compared. R.D.Smith

ASTRONOMY . ASTROPHYSICS . GEODESY 52

522.61 : 551.508.25

9494. A TRANSPARENT POLARIZING FILTER FOR OBSERVING THE SOLAR CORONA, POLAR AURORAE AND LUMINESCENCE OF THE UPPER ATMOSPHERE. A.Dollfus.
C.R. Acad. Sci. (Paris), Vol. 245, No. 1, 32-5 (July 1, 1957). In French.

Details are given of a new design of quartz interference filter of large aperture and high transmission to visible radiation. The number of polarizing elements is reduced to five, and the effective area of the filter is increased to ~ 8 cm^2 with an angular field of ~ 12 degrees. Control of the waveband transmitted by the filter is effected by varying the temperature of the filter cell over the range 19.0 to 50.5°C. The bandwidths increase from 1.5 A at 5500 A to 2.8 A at 6500 A, with effective transmissions of around 25%. One advantage for solar work is the ability to observe the coronal radiations at 5694 A and 6374 A simultaneously with a single adjustment of the operating temperature. D.R.Barber

523.12

9495. ON THE AGE OF THE UNIVERSE. M.Pierucci.
Nuovo Cimento (Ser. 10), Vol. 5, No. 3, 572-8 (March, 1957). In Italian.

An earlier estimate (1951) was based on an assumed value for the ratio of the initial and present densities of the universe. It is now suggested that this ratio may be replaced by that of the present densities of galaxies and galactic clusters, and the age is estimated to be about 10^{10} years. R.A.Newing

523.164 : 621.396.677.833.2 : 621.317.6

9496. CONCERNING A METHOD OF MEASUREMENT OF POLAR DIAGRAMS OF RADIO-TELESCOPES WITH HIGH RESOLVING POWER. N.A.Esepkina.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 1, 94-6 (1957). In Russian.

The aperture phase distribution of a parabolic reflector is changed by displacing the radiator from the focus, so that the polar diagram can be measured at a calculated, practical, distance from the antenna. The theory was checked on a parabolic reflector $a = 75$ cm, $\lambda = 3$ cm, $a^2/f = 1.1$ and good coincidence between diagrams taken at a distance of 150 m with the radiator at the focus, and 13 m with the radiator displaced 3 cm was obtained. The method is considered suitable for radio-telescopes with very narrow polar diagrams. P.Collins

523.164

9497. THE MULLARD RADIO ASTRONOMY OBSERVATORY, CAMBRIDGE. M.Ryle.
Nature (London), Vol. 180, 110-12 (July 20, 1957).

This account of radio-astronomical developments in Cambridge contains a discussion of the "aperture-synthesis" technique for increasing the resolving power and collecting area of a radio-telescope, and its practical application. M.W.Ovenden

523.164.3

9498. SOURCES OF RADIO NOISE ON THE PLANET JUPITER. C.H.Barrow, T.D.Carr and A.G.Smith.
Nature (London), Vol. 180, 381 (Aug. 24, 1957).

A series of observations of radio noise from Jupiter at 18.0 Mc/s was made during the period December 31, 1956 to March 8, 1957 with an eight-dipole array having a half-power beam-width of about 30^0 in the east-west direction. Thirty seven records showing Jovian radiation with some certainty were obtained. Plotted against zenocentric longitude System I, the longitudes were more or less random; on System II, two maxima were obtained corresponding to longitudes centred on 105^0 and 210^0, each band having a width of about 90^0. In addition to these two sources, there was a possible third, fainter source at longitude 290^0, near the Red Spot. The narrow longitude bandwidths indicate refraction in a Jovian ionosphere, with an electron density or the order of 10^6 cm^{-3}. M.W.Ovenden

523.165

9499. FACTORS AFFECTING THE GALACTIC DIFFUSION OF COSMIC RAYS. H.Laster.
Phys. Rev., Vol. 107, No. 4, 1112-18 (Aug. 15, 1957).

Some of the effects of spatial and time inhomogeneities upon the galactic diffusion of cosmic rays are studied. It is noted that the ways in which spatial inhomogeneities alter the anisotropy with changing energy are very dependent upon the particular model for cosmic-ray origins chosen. The consequences of assuming bursts of cosmic rays occurring randomly in time instead of continuously are examined. It is shown that in a monoenergetic approximation this possibility would be unobservable, regardless of the frequency of the bursts. The above calculations are first done for generalized medium shapes. They are then applied to a specific model in order to examine their consequences. A.

523.3

9500. LUNAR RAYS. J.A.O'Keefe.
Astrophys. J., Vol. 126, No. 2, 466 (Sept., 1957).

Reasons are advanced for identifying the "lunar rays" with localized concentrations of small transparent spheres which possess the property of returning the incident light-rays chiefly along the direction from which they came, since the lunar rays are most conspicuous when the source of light and the observer are nearly in the same line. D.R.Barber

523.32

9501. SHORT TIME TRANSIENTS IN SOLAR NOISE. T.de Groot.
Nature (London), Vol. 180, 382 (Aug. 24, 1957).

Preliminary measurements of solar radiation at 400 Mc/s on a dozen days spread over three months yielded a histogram of durations of short-time transients with a sharp maximum at 0.18-0.03 sec. No correlation was found between duration and height of "pips". On Aug. 29, 1956, a period between pips of 0.25 ± 0.04 sec was observed. M.W.Ovenden

523.74

9502. ANISOTROPY OF SOLAR CONVECTION. W.Unno.
Astrophys. J., Vol. 126, No. 2, 259-65 (Sept., 1957).

A possible source of the observed anisotropy in the solar turbulence is the convective flow which originates in the lower unstable layer of the photosphere and penetrates into the upper stable layer. In this convective flow the horizontal velocity is found to be larger than the vertical one for all eddies with horizontal diameters larger than about one scale height. Quantitative agreement between computed and observed anistropy is obtained for eddy diameters of two to six times the scale height. A.

523.74 : 778

9503. SOLAR GRANULATION AND ITS OBSERVATION FROM A FREE BALLOON. D.E.Blackwell, D.W.Dewhirst and A.Dollfus.
Nature (London), Vol. 180, 211-13 (Aug. 3, 1957).

To counter the effects of low-level atmospheric turbulence on the resolution obtainable in direct photography of the solar disk at ground-level stations, an attempt has been made to photograph the sun with an airborne camera (f.l. = 120 in.) suspended below a piloted balloon. The first flight was unsuccessful owing to the use of too long an exposure time (2 msec). On the second, this time was reduced to 0.2 msec and a series of successful photographs was obtained at heights around 18 000 ft that show a resolution better than 1.3 second of arc, very near the theoretical limit for the 11 in. objective employed. D.R.Barber

523.741

9504. THE DEVIATION FROM LOCAL THERMODYNAMIC EQUILIBRIUM IN THE SOLAR PHOTOSPHERE. J.C.Pecker.
C.R. Acad. Sci. (Paris), Vol. 245, No. 5, 499-502 (July 29, 1957). In French.

A study of the central intensities of titanium lines leads to the conclusion that there is no local thermodynamic equilibrium within the photospheric layers. A.Beer

523.746

9505. A STATISTICAL MODEL FOR SUNSPOT ACTIVITY. C.W.J.Granger.
Astrophys. J., Vol. 126, No. 1, 152-8 (July, 1957).

By an empirical approach, a simple two-parameter statistical model is proposed for fitting to the Wolf sunspot number data and a fit of around 88% of the total variation is found. Properties of the two parameters are discussed, and other possible relationships between measurable elements of the cycles are suggested. A.

523.841.11 : 523.877

9506. THE ELEMENT Cf^{254} AND THE LIGHT CURVES OF TYPE I SUPERNOVAE. A CONTRIBUTION TO THE QUESTION OF THE COSMIC SYNTHESIS OF HEAVY ELEMENTS. S.Temesváry.
Naturwissenschaften, Vol. 44, No. 11, 321-3 (1957). In German.

In a report on recent theories of the synthesis of heavy elements, detailed consideration is given to the question of the formation of Cf^{254} in a supernova outburst and to the association of the linear decrease in the light curves of type I supernovae with the spontaneous fission of Cf^{254}. R.A.Newing

523.875

9507. THE COLOUR-INDEX-GRADIENT DIAGRAM. L.Divan and A.M.Rozis-Saulgeot.
C.R. Acad. Sci. (Paris), Vol. 245, No. 3, 281-4 (July 17, 1957). In French.

A plot of the spectrophotometrically measured blue gradients against the blue-yellow indices of the Johnson–Morgan photometric system supplies a new confirmation of the existence of a discontinuity in the continuous spectrum in the visible region of the hottest stars. A.Beer

523.877

9508. REVISION OF THE THEORY OF THE CURVES OF GROWTH. J.C.Pecker.
C.R. Acad. Sci. (Paris), Vol. 245, No. 6, 639-42 (Aug. 5, 1957). In French.

The existence of deviations from thermodynamic equilibrium leads to a modification of the theory of the weight functions and to important numerical changes in the given constants (temperatures, abundances, turbulence) as derived from the curves of growth. A.Beer

529.786 : 621.317.39

9509. THE CAESIUM RESONATOR AS A STANDARD OF FREQUENCY AND TIME. L.Essen and J.V.L.Parry.
Phil. Trans. A, Vol. 250, 45-69 (Aug. 8, 1957).

The construction, operation, and testing of the standard are described. The resonance employed is that due to the hyperfine splitting of caesium, having a frequency of approximately 9192 Mc/s. The transitions between the two atomic states $F,m_F(4,0)$ and $F,m_F(3,0)$ are detected in an atomic-beam chamber, in which the length of the transition region is 47 cm, giving a width of resonance, at half deflection, of 350 cycles, and a standard deviation of setting to the peak of the resonance of ± 1 c/s. The resonator is used as a passive instrument to calibrate the quartz clocks, usually at intervals of a few days; and it is estimated that the clocks calibrated in this way provide at all times the atomic unit of frequency and time interval with a standard deviation of ± 2 parts in 10^{10}. A.

PHYSICS 53

FUNDAMENTALS 530.1

530.112

9510. THE ETHER AND SPECIAL RELATIVITY. A.Datzeff.
C.R. Acad. Sci. (Paris), Vol. 245, No. 8, 827-9 (Aug. 19, 1957). In French.

It is suggested that the concept of an ether might be revived if it is assumed that its properties become suitably modified in limited regions of undefined extent around moving bodies.

R.A.Newing

530.12

9511. THE "CLOCK PARADOX" OF RELATIVITY. F.S.Crawford, Jr.
Nature (London), Vol. 179, 1071-2 (May 25, 1957).

Dingle's position is criticized for using the synchronization condition $t_3 = \frac{1}{2}(t_1 + t_3)$ for relatively moving clocks, this condition being restricted by Einstein to relatively stationary clocks. It is also noted that Dingle's qualitative argument neglects acceleration relative to the remaining matter in the universe. R.A.Newing

530.12

9512. SPACE-TIME STRUCTURE OF A STATIC SPHERICALLY SYMMETRIC SCALAR FIELD. O.Bergmann and R.Leipnik.
Phys. Rev., Vol. 107, No. 4, 1157-61 (Aug. 15, 1957).

The Einstein equations of the general theory of relativity are solved for an energy-momentum tensor derived from a linear scalar field theory specialized to a static spherically symmetric field of a point-like source. This is the scalar analogue to the structure of the field about a point electron. However, the mathematics is more complicated. A two-parameter family of line elements and associated fields is discovered, of which the Schwarzschild solutions form a one-parameter subfamily. The g_{ik} and field variable V can be only implicitly expressed as algebraic and logarithmic functions of r, except for special one-parameter subfamilies where explicit expressions are obtainable. However, asymptotic approximations for large and small radius are derived except for one of the one-parameter subfamilies. A

530.12

9513. THE EQUATIONS OF MOTION IN THE GENERAL THEORY OF RELATIVITY. H.J.Meister.
Ann. Phys. (Leipzig), Vol. 19, No. 6-8, 268-82 (1956). In German.

Using the Fock–Papapetrou approximation method for weak fields, it is shown that the field equations determine the shape of a uniformly moving fluid body. With the de Donder coordinate condition, the body is spherically symmetric in the first approximation, but exhibits the Lorentz contraction in the second approximation. The results are extended to slowly accelerated bodies. The equations of motion for two-fluid bodies, obtained to the second order of approximation, agree with earlier results derived without consideration of Lorentz contraction, but there is a second-order difference in the metric tensor. R.A.Newing

530.12

9514. VARIATIONAL EQUATIONS OF GENERAL RELATIVITY. É.Faivre-Blancheton.
C.R. Acad. Sci. (Paris), Vol. 245, No. 3, 284-6 (July 17, 1957). In French.

The equations are formulated, and the Cauchy problem considered for a metric tensor of the form $g_{\alpha\beta} = a_{\alpha\beta} + \epsilon\gamma_{\alpha\beta} + 0(\epsilon^2)$, $a_{\alpha\beta}$ being a known solution of the field equations.

R.A.Newing

530.12

9515. FINSLER GEOMETRY AND UNIFIED FIELD THEORIES. G.Stephenson.
Ann. Inst. Poincaré, Vol. 15, No. 3, 205-15 (1957). In French.

A brief discussion is given of the aims and difficulties of certain unified field theories. In particular the theory proposed by Stephenson and Kilmister (Abstr. 8209/1953) and based on the metric $ds = A_\mu dx^\mu + \sqrt{g_{\mu\nu}\, dx^\mu dx^\nu}$ is developed further using the methods of Finsler geometry (see also Horvath, Abstr. 67/1957). It is shown that this approach does not give rise to the field equations of the Einstein–Maxwell theory and that this particular Finsler theory is physically unsatisfactory. Reasons are given for the suggestion that a scalar field should be introduced into unified theories. G.Stephenson

530.12

9516. NATURE OF "p" IN BONNOR'S UNIFIED FIELD THEORY. M.L.Abrol.
Nuovo Cimento, Vol. 6, No. 1, 230-4 (July, 1957).

By considering the charge distribution of a spherically symmetric particle at rest in Bonnor's unified field theory (Abstr. 709/1955) it is suggested that the arbitrary constant "p" should be taken as real. G.Stephenson

530.12

9517. CIRCULATION — CLUE TO A UNIFIED THEORY? O.Buneman.
Nuovo Cimento Suppl. (Ser. 10), Vol. 5, No. 1, 92-119 (1957).

Matter is represented geometrically by a continuous 3-parameter family of worldlines. The geodesic equations of a free-particle are shown to be equivalent to the conservation of circulation $\oint u_\nu dx^\nu$, where u^ν (= dx^ν/ds) is the tangent four-vector to a worldline. A modified circulation law gives the equations of motion for a charged fluid. Particles are represented as bundles of worldlines in the continuous substratum and these bundles are shown to possess many particle like properties. Quantization is introduced by allowing the circulation to take only integral multiples of a fundamental length. G.Stephenson

530.145

9518. UNIFIED DESCRIPTION OF ORDINARY AND ISOTOPIC SPACE. D.Ivanenko and H.Sokolik.
Nuovo Cimento, Vol. 6, No. 1, 226-9 (July, 1957).

In order to deal with a possible fusion of these spaces, the classification of n-dimensional equations of the form

$$\Gamma_i \frac{\partial \psi}{\partial x_i} + \kappa\psi = 0$$

according to representations of an n-dimensional group of rotations and inversions is treated. G.E.Brown

530.145

9519. A FORMAL THEORY OF QUANTUM CLASSIFICATION. I. S.Golden.
Nuovo Cimento Suppl. (Ser. 10), Vol. 5, No. 3, 540-67 (1957).

The idea of classification is defined, and it is assumed that in applications to quantum systems the appropriate mechanism is an extended form of Boolean algebra, the Boolean elements being replaced by operator elements satisfying quantum restrictions. The physical interpretation of the operators in terms of a process of measurement is discussed. The treatment displays explicitly those features of a measurement which result in an essential alteration of the system. P.M.Davidson

530.145

9520. SOME EXPERIMENTAL TESTS OF THE LÜDERS THEOREM. H.P.Stapp.
Phys. Rev., Vol. 107, No. 2, 634 (July 15, 1957).

It is important that experiments on the recently discovered failure of the symmetry laws should indicate unambiguously just which of the laws is in error. Suitable experiments are here outlined. It is noted that on the basis of existing theory such failures could only be explained by procedures which (like the rather unsatisfactory renormalization processes employed in recent years) suggest that the error is really of a fundamental nature, connected with the concept of the space–time point. P.M.Davidson

530.145

9521. NONRELATIVISTIC LIMIT OF A BETHE–SALPETER EQUATION. G.Wanders.
Helv. phys. Acta, Vol. 30, No. 5, 417-46 (1957). In French.

A bound state of two scalar particles with mass m is described relativistically by a wave-function $\Phi(x_1, x_2)$, which is a solution of a Bethe–Salpeter equation. Wick and Cutkosky were able to discuss the "ladder approximation" of this equation quite completely, in the special case of scalar photons as binding particles. This paper presents an extension of their results to the case of a binding due to scalar mesons, with nonvanishing mass μ. The wave-function of an S-state has a two-parameter integral representation, the Bethe–Salpeter equation being equivalent to an integral equation for the weight function of this representation. In spite of the intricate structure of this equation, it is possible to investigate its nonrelativistic, or static limit, where the bound particles become infinitely

heavy ($m \to \infty$). In this limit, the set of eigenvalues of the Bethe–Salpeter equation corresponding to the value $\kappa = 0$ of the new quantum number κ is identical with the spectrum of the Schroedinger equation with a Yukawa potential. These results are the natural generalization of those obtained by Wick and Cutkosky. Moreover, the limit of the wave-function $\Phi(x_1,x_2)$ is identical, in the plane $t_1 = t_2 = t$ with the corresponding ordinary Schroedinger wave-function. See also Abstr. 1927 (1957). A.

530.145

9522. QUANTUM FIELD THEORY IN TERMS OF ORDERED PRODUCTS. S.N.Gupta.
Phys. Rev., Vol. 107, No. 6, 1722-6 (Sept. 15, 1957).

A formulation of the quantum theory of fields is given, which is based on the idea of ordered products and has the following advantages: (1) The formalism is completely free from any ambiguity in the order of field operators. (2) The zero-point energy of fields vanishes. (3) The zero-point charge of fields vanishes without the use of any special device. (4) The formalism gives new information about nonlinear interactions of fields. A.

530.145

9523. ON THE GENERALIZED WARD IDENTITY. Y.Takahashi.
Nuovo Cimento, Vol. 6, No. 2, 371-5 (Aug., 1957).

Ward's identity (Abstr. 6241/1950) shows the relation between the vertex operator with equal electron momenta and the electron propagator. A generalization of it for the case where the electron momenta are not equal has been used by many authors, but has never been rigorously proved. It is proved in this paper without recourse to perturbation expansion or Feynman's diagram. It is shown to be a consequence of the conservation of the current. P.M.Davidson

530.145

9524. A GAUGE INVARIANT LAGRANGIAN FOR A NON-LOCAL ELECTRODYNAMICS. P.Sen.
Nuovo Cimento, Vol. 6, No. 2, 400-2 (Aug., 1957).

530.145

9525. THE RADIATION OF A POINT CHARGE MOVING ALONG THE BOUNDARY OF SEPARATION OF TWO MEDIA.
V.E.Pafomov.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 610 (1957). In Russian.

It is claimed that there are errors in the partial discussion of this problem (i.e. charge moving along a plane boundary separating a vacuum and a dielectric) by Danos (Abstr. 1910/1955) whilst in Linhart's discussion (Abstr. 6221/1955) incorrect results are obtained. The current paper is devoted to a determination of the angular radiation energy distribution for the motion of an electron above the boundary of separation of two dielectrics. The electron is considered moving with uniform velocity in a straight line at constant distance from the boundary separating the two media of dielectric (real) constants ϵ_1 and ϵ_2. Results are given for two cases: (i) where ($\epsilon_1\beta^2 < 1$, $\epsilon_2\beta^2 > 1$) and (ii) where ($\epsilon_1\beta^2 > 1$, $\epsilon_2\beta^2 > 1$, $\epsilon_1 > \epsilon_2$). When the electron actually moves in the surface of separation forces arise deflecting it from its rectilinear motion.

C.R.S.Manders

530.145

9526. LONGITUDINAL POLARIZATION OF BREMSSTRAHLUNG AND PAIR PRODUCTION AT RELATIVISTIC ENERGIES.
K.W.McVoy and F.J.Dyson.
Phys. Rev., Vol. 106, No. 6, 1360-1 (June 15, 1957).

Theoretical. By using the explicit form of the spinors for longitudinally polarized particles it is possible, in the case of relativistic energies, to determine in a simple way the differential cross-sections for bremsstrahlung and pair production with specific longitudinal polarization for the incident and outgoing particles. The integration over the angular variables can also be performed and the final formulae bring out well the symmetry between the two phenomena and also the origin of the unsymmetrical factors which appear in the unpolarized cross-section. They also indicate the possibility of a large-scale persistence of longitudinal polarization in an electromagnetic cascade originated by a single polarized electron of high energy. L.Pincherle

530.145

9527. ON PARITY CONSERVATION AND NEUTRINO MASS.
A.Salam.
Nuovo Cimento (Ser. 10), Vol. 5, No. 1, 299-301 (Jan., 1957).

The free neutrino Lagrangian is invariant for the substitution $\psi_\nu \to \gamma_5\psi_\nu$. It is postulated that the total Lagrangian also remains invariant for the same substitution. Since ψ_ν and $\gamma_5\psi_\nu$ have opposite intrinsic parity most neutrino interactions will then violate parity conservation. Consequences of the postulated invariance are discussed. In particular it is shown that for the π, $K_{\mu\nu}$ and neutron decay it is possible either to conserve parity with zero neutrino mass by postulating a parity degeneracy of electrons and μ-mesons (which is unsatisfactory), or to admit parity violation through two distinct ways: (a) through $m_\nu = 0$; (b) in $K_{\pi\pi}$ and $K_{\pi\pi\pi}$ decays. Also this is unsatisfactory: the ideal would be to link all parity violations with the "neutrino gauge" requirement $m_\nu = 0$. A suggestion is made on how this might occur. L.Pincherle

530.145

9528. PARITY CONSERVATION AND THE MASS OF THE NEUTRINO. B.F.Touschek.
Nuovo Cimento (Ser. 10), Vol. 5, No. 3, 754-5 (March, 1957).

The mass of the neutrino can be defined to be zero by the requirement that the equations of motion of the free neutrino field are invariant under the transformation $\psi_\nu \to \exp(i\gamma_5\alpha)\psi_\nu$, where α is a real number. If the neutrino interacts with other particles, the operators describing these particles must undergo a corresponding transformation and one may choose $\psi_i \to \exp(in_i\alpha)\psi_i$, valid for all fields except that of the neutrino, and in which n_i is a number characteristic of the ith field. If one tries then to construct a Lagrangian in which neutrinos can be produced or annihilated, one finds that it is not invariant under space reflections. L.Pincherle

530.145 : 539.18

9529. POSSIBLE DETECTION OF PARITY NON-CONSERVATION IN HYPERON DECAY.
T.D.Lee, J.Steinberger, G.Feinberg, P.K.Kabir and C.N.Yang.
Phys. Rev., Vol. 106, No. 6, 1367-9 (June 15, 1957).

If parity is not conserved in hyperon decay, the polarization of the hyperon can be measured by observations on the angular distribution of the decay secondaries. Expressions are derived for the asymmetry parameter for Λ^0 and Σ^- decays, following production near the threshold, valid for invariance under time reversal and charge conjugation respectively. K.H.Barker

530.145 : 539.18

9530. EXPERIMENTAL SITUATION ON PARITY DOUBLING.
F.Eisler, R.Plano, N.Samios, M.Schwartz and J.Steinberger.
Phys. Rev., Vol. 107, No. 1, 324-5 (July 1, 1957).

It is pointed out that parity doubling in the form proposed by Treiman and Wyld (Abstr. 7418/1957), requiring a short-lived K^+-meson, can be ruled out on experimental grounds.

R.H.W.Johnston

530.145

9531. CHARGES AND PARITIES OF ELEMENTARY PARTICLES.
D.W.Sciama.
Phys. Rev., Vol. 107, No. 2, 632-3 (July 15, 1957).

It is supposed that the gravitational potential of a particle with spin is a real nonsymmetric second-rank tensor. Among the consequences of the resulting theory is that all singly charged bosons are pseudoscalars (or vectors, etc.). J.S.Bell

530.145

9532. ELECTROMAGNETIC PROPERTIES OF NUCLEONS AND BARION–HEAVY MESON INTERACTIONS. B.Vitale.
Nuovo Cimento (Ser. 10), Vol. 5, No. 3, 732-6 (March, 1957).

Discusses the effects of baryon–heavy meson couplings on fixed source calculations of the anomalous nucleon magnetic moment, electron–neutron interaction, and pion–nucleon scattering.

J.W.G.Wignall

530.145

9533. ON THE THEORY OF LEPTONS. K.Nishijima.
Nuovo Cimento (Ser. 10), Vol. 5, No. 5, 1349-54 (May, 1957).

A new invariance principle for lepton wave-equations is proposed, and applied in a discussion of decay and interaction processes caused by weak interactions. J.W.G.Wignall

530.145

9534. SOME THEORETICAL CONSEQUENCES OF A PARTICLE HAVING MASS ZERO. S.A.Bludman.
Phys. Rev., Vol. 107, No. 4, 1163-8 (Aug. 15, 1957).

When the mass is zero, the operator γ_5 commutes with the Hamiltonian of a noninteracting spinor field. This leads to the possibility of a two-component neutrino that has been employed in connection with parity-nonconserving neutrino reactions. Every representation of the full inhomogeneous Lorentz group describing a free particle of arbitrary nonzero spin can be split in the same way when the mass is zero. In particular, a reduction of the free electromagnetic field from six components to three, is exhibited in a way exactly analogous to the reduction of four-component massless spinors to two components. This illustrates the fact that parity nonconservation, when it occurs, cannot be a result of any intrinsic

property of a free field, but must, instead, be ascribed to particular interactions occurring in nature. The possibility of relating the γ_5 degeneracy of the massless spin one-half field to its invariance under conformal coordinate transformations is discussed. The two-component free Dirac particle is invariant under the conformal point transformations, and also under the reciprocal radius transformations. Some different definitions of the conformal group are distinguished. A.

530.145

9535. MAGNETIC DIPOLE MOMENT OF THE BHABHA SYSTEM. R.L.Pease and J.Pease.
Phys. Rev., Vol. 107, No. 4, 1169 (Aug. 15, 1957).

A systematic procedure was recently developed for extracting the intrinsic moments of a system described by the general first-order linear field equation $(i\beta^\mu \partial_\mu + k)\psi = 0$ (Abstr. 1897/1957). The procedure is applied to compute the magnetic dipole moments of a dibaric system proposed by Bhabha (Abstr. 1445/1952). A.

530.145

9536. SOME REMARKS ABOUT A PAPER BY FUKUTOME AND NOGAMI. M.Cini and S.Fubini.
Nuovo Cimento (Ser. 10), Vol. 5, No. 5, 1371-3 (May, 1957).

This is a summary of the conclusions of Cini, Fubini, and collaborators, on the character of the exact solution of the fixed-source meson theory as indicated by exact sum rules. Criticism thereof by Fukutome and Nogami (Abstr. 8402/1957) is rejected. J.S.Bell

530.145

9537. CORRECTIONS TO DISPERSION RELATIONS. A.Agodi, M.Cini and B.Vitale.
Phys. Rev., Vol. 107, No. 2, 630-1 (July 15, 1957).

The influence of interaction with photons, hyperons, and heavy mesons, on meson–nucleon dispersion relations is considered. Only the electromagnetic field has an effect, which is too small to account for the results of Puppi and Stanghellini (Abstr. 8408/1957). J.S.Bell

530.145

9538. DISPERSION RELATIONS FOR MESON–NUCLEON SCATTERING. E.Kazes.
Phys. Rev., Vol. 108, No. 1, 123-5 (Oct. 1, 1957).

Fourth-order meson–nucleon scattering amplitudes show that at least one subtraction is required for the no-spin-flip amplitudes and that subtraction is not needed for the spin-flip amplitudes used by Goldberger. A.

530.145

9539. PION CONTRIBUTION TO HYPERON–NUCLEON FORCES. D.B.Lichtenberg and M.H.Ross.
Phys. Rev., Vol. 107, No. 6, 1714-21 (Sept. 15, 1957).

A calculation is made of the forces between hyperons and nucleons under the assumption that the forces are due to the exchange of pions. The Λ and Σ are assumed to have spin $\frac{1}{2}$ and the same parity. The Hamiltonian is taken to be the same as the static-model pion–nucleon Hamiltonian except for differences in isotopic spin and possibly in the strength of the coupling. The same approximations are made as those ordinarily made in evaluating the nucleon–nucleon potential, although it is noted that in case all the pion–baryon coupling constants are equal, the hyperon–nucleon potentials are just linear combinations of the observed nucleon–nucleon potentials. The pion–hyperon coupling constant is determined by comparison with potentials obtained from analysis of hyperfragment data. The resulting value is about the same as the pion–nucleon constant. The elastic hyperon–nucleon and $\Lambda + N \leftrightarrow \Sigma + N$ scattering cross-sections are evaluated. Results are consistent with experiment. A.

530.145

9540. PION–NUCLEON S-WAVES AND K-MESONS. P.Budini, N.Dallaporta and L.Fonda.
Nuovo Cimento, Vol. 6, No. 2, 380-2 (Aug., 1957).

Calculation of S-wave pion–nucleon scattering, using a non-local theory resulting from the assumption that an intermediate K-meson field takes part in the pion–nucleon interaction (Abstr. 8989/1957). J.W.G.Wignall

530.145

9541. GENERALIZED EFFECTIVE RANGE THEORY FOR NUCLEON–NUCLEON SCATTERING. R.B.Raphael.
Phys. Rev., Vol. 107, No. 4, 1135-44 (Aug. 15, 1957).

A method is proposed for obtaining limitations on the shape and possible energy dependence of the force in a given scattering state of the two-nucleon system, from a knowledge of the phase shift in that state over the nonrelativistic domain, and is illustrated for ^1S waves. A.

530.145

9542. SPIN REVERSAL IN SCATTERING PROCESSES. A.Lenard.
Phys. Rev., Vol. 107, No. 6, 1712-13 (Sept. 15, 1957).

The effect on the scattering matrix element of reversing the spins of all particles is discussed. An exact relation is shown to be the consequence of invariance under combined space and time inversion and the unitarity of the S-matrix. In lowest order perturbation theory this gives a symmetry property of the matrix element. The implication for particles in arbitrary states of polarization is pointed out. A.

530.145

9543. DEPENDENCE OF THE EFFECTIVE CROSS-SECTION OF INELASTIC SCATTERING OF A PARTICLE ON ENERGY NEAR THRESHOLD. G.F.Drukarev.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 601-3 (1957). In Russian.

The problem is that of the scattering of a particle "b" by a stationary centre of force with a particle "a" bound to it. The first terms in an expansion in the wave number are derived. G.E.Brown

530.145

9544. POLARIZATION IN INVERSE REACTIONS. A.I.Baz'.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 628-30 (1957). In Russian.

Relations connecting the asymmetry in the direct reaction with the polarization in the inverse reaction, and the polarization of the target in the direct reaction with the correlation polarization in the inverse one are derived for collision of a spin-$\frac{1}{2}$ particle with a spin-$\frac{1}{2}$ target. G.E.Brown

530.145

9545. ANALYTICITY OF THE SCHRÖDINGER SCATTERING AMPLITUDE AND NONRELATIVISTIC DISPERSION RELATIONS. N.N.Khuri.
Phys. Rev., Vol. 107, No. 4, 1148-56 (Aug., 1957).

The Fredholm theory of integral equations is used to give a rigorous proof of the analyticity and boundedness of the ordinary nonrelativistic scattering amplitude for a fixed momentum transfer. The results follow from ordinary quantum mechanics and certain conditions on the potentials. These conditions are stated explicitly, and the bound states are treated with rigor. It is shown that the amplitude vanishes in the limit of large momenta, and thus simple dispersion relations are derived. Finally, it is proved that the partial-wave expansion is convergent in the unphysical region, provided the potentials satisfy the same conditions as above. A.

530.145

9546. CONVERGENT SCHRÖDINGER PERTURBATION THEORY. G.Speisman.
Phys. Rev., Vol. 107, No. 4, 1180-92 (Aug. 15, 1957).

A formulation of Schrödinger perturbation theory is developed that gives a unified treatment of nondegenerate and degenerate cases, is unique, and has a nonzero radius of convergence under very general conditions. Two alternative procedures are given for finding perturbed eigenvectors, one of which is simpler for the nondegenerate case or for small finite degeneracy, the other simpler for infinite or large finite degeneracy. The low-order terms in the perturbation expansions of quantities used in applications are given. The perturbation theory formulated has the following advantages over the conventional Schrödinger and Brillouin–Wigner perturbation theories: (i) when the convergence criterion is satisfied, bounds on the error made in replacing an appropriate infinite perturbation series by its first n terms can be obtained: (ii) for the case of degeneracy, the conventional Schrödinger perturbation theory can break down under conditions to which the convergence of the perturbation theory developed in this paper are insensitive; (iii) there is no implicit dependence on the eigenvalue, such as appears in the Brillouin–Wigner perturbation theory; (iv) for the case of degeneracy, statistical information about the distribution of certain eignevalues can be obtained without finding the individual eigenvalues; (v) the theory is applicable to a wider class of problems than the conventional Schrödinger and Brillouin–Wigner perturbation theories. A.

530.145

9547. QUANTUM MECHANICS WITH AN INDEFINITE METRIC. S.N.Gupta.
Canad. J. Phys., Vol. 35, No. 8, 961-8 (Aug., 1957).

The formalism of quantum mechanics in a vector space for an

indefinite metric is developed in a simplified way, and the properties of the indefinite vector space are discussed in detail with particular attention to vectors of negative and vanishing norms. It is shown how the present formalism simplifies the use of the indefinite metric in physical applications. A.

530.145

9548. METHOD OF MOMENTS IN QUANTUM MECHANICS. F.R.Halpern.
Phys. Rev., Vol. 107, No. 4, 1145-7 (Aug. 15, 1957).

An approximation technique for quantum-mechanical problems based on the expectation values of the powers of the Hamiltonian is developed. The mathematical foundations on which this approach is based are the method of moments employed in probability theory, and the theory of orthogonal polynomials. In practice this method constitutes an extension of the Rayleigh–Ritz principle and gives a systematic method of improving the trial function. A.

530.145

9549. STRUCTURE OF A MANY-PARTICLE QUANTUM-MECHANICAL MEDIUM. R.Karplus and K.M.Watson.
Phys. Rev., Vol. 107, No. 5, 1205-18 (Sept. 1, 1957).

A discussion is given of the wave-function of a many-particle system. The wave-function itself is quite complex, containing all combinations of "clusters" of interacting particles. Expectation values, however may be calculated in a straightforward manner, as is shown in detail. In particular, the expectation value of an operator may be expanded in "linked clusters", each "linked cluster" being weighted with its probability of occurrence in the wave-function. The theory is applied to the calculation of the momentum spectrum and pair correlation function for a dilute gas, a degenerate Fermi–Dirac system, and a degenerate Bose–Einstein system of hard spheres. A.

530.162

9550. ON THE STATISTICS OF [CLASSICAL] SYSTEMS OF SIMILAR [SPHERICALLY SYMMETRICAL] PARTICLES. P.S.Pütter.
Ann. Phys. (Leipzig), Vol. 19, No. 3-5, 145-65 (1956). In German.

The concept of probability in phase space is discussed. The equations are derived by two theories of ensemble averaging. Firstly, the average behaviour of every particle of an individual system is analysed, and secondly, the average behaviour of one particular particle repeated over infinitely many systems. In both cases the general theory gives a set of exact partial differential equations, which are shown to be mathematically equivalent, and the same as those of Born and Green (Abstr. 771/1947). The relative usefulness of the theories is discussed. The first is widely applicable by adaptation of the definitions, but the distribution function is not exactly given, and spatial inhomogeneities (e.g. boundaries) cannot be treated easily. The local particle density is derived. In the second, the statistical concept is clearer, whereas the behaviour of individual systems is not. In this case, quasi-ergodicity is noted, and spatial inhomogeneities can be treated. Calculation of the approximate distribution function by terminating the set of equations is discussed. P.Gray

530.162

9551. APPLICATIONS OF THE FUNDAMENTAL DYNAMICAL EQUATIONS OF CLASSICAL STATISTICS. P.S.Pütter.
Ann. Phys. (Leipzig), Vol. 19, No. 3-5, 247-56 (1956). In German.

See preceding abstract. The range of validity of the equations is increased by their concurrence. The Maxwell distribution of velocities is deduced, and the local particle density is found to have a hydrostatic form, in equilibrium. Assuming simple collisions, the Maxwell–Boltzmann collision equation is deduced, and the distribution function is given for the locality. The influence of the rest of the system on the locality appears as an external additional potential. P.Gray

530.162 : 536.7

9552. THE STATISTICAL THERMODYNAMICS OF MIXTURES OF LENNARD-JONES MOLECULES. I. RANDOM MIXTURES. W.B.Brown.
Phil. Trans A, Vol. 250, No. 976, 175-220 (1957).

Describes a development in the statistical theory of mixtures of spherical molecules. It is shown that for a mixture of molecules interacting according to the Lennard-Jones inverse-power potential, the assumption of random mixing is sufficient to relate the thermodynamic properties of the mixture exactly to those of a reference substance, after the manner of the law of corresponding states; and it is proved in an appendix that only the Lennard-Jones form of the potential energy function leads to this simple result. If the molar configurational Gibbs function of the reference substance is $G_0(T,P)$, then that of the random mixture is

$$G(T,P,x) = f_x G_0(T/f_x, Ph_x/f_x) - RT \ln h_x + RT \sum_\alpha x_\alpha \ln x_\alpha,$$

where x_α is the mole fraction of component α, and where f_x and h_x are dimensionless functions of the composition involving the characteristic molecular energy and size constants for the interactions of the various species. This equation is used to discuss the phenomena peculiar to mixtures of substances, under the headings: mixing effects, phase equilibria, and critical phases. A necessary condition on the intermolecular forces for azeotropy to occur in binary mixtures is derived in a simple form which can be appreciated intuitively; the possibility of a lower critical solution point in these mixtures is examined and shown to be unlikely; and the difficulties in the way of deriving the critical or plait-point curve are outlined. The liquid mixing properties of the system carbon monoxide + methane are calculated from the theory, and shown to be in fair agreement with experiment. The Gibbs function of the mixture is analysed by a Taylor-series expansion, and it is shown that the first-order terms of the present theory are identical with those of the theory of conformal solutions, due to Longuet-Higgins, but that the second-order terms involve approximations, resulting from the assumption of random mixing. Expanded forms of the mixing functions are derived for the special class of binary mixtures whose characteristic energy and size constants obey geometric and arithmetic mean rules respectively, and the signs of these functions are discussed. A.

530.162 : 536.7

9553. THE STATISTICAL THERMODYNAMICS OF MIXTURES OF LENNARD-JONES MOLECULES. II. DEVIATIONS FROM RANDOM MIXING. W.B.Brown.
Phil. Trans A, Vol. 250, No. 976, 221-46 (1957)

Describes a new statistical treatment of ordering effects in mixtures of spherical molecules, based on a general expansion of the Helmholtz free-energy function about the condition of random mixing. This expansion is similar to that introduced by Kirkwood (1938) for lattice theories, but unlike the latter is based only on the canonical distribution of petit ensemble theory. It is shown that for mixtures of Lennard-Jones molecules the moments in the expansion can be reduced to non-thermodynamic statistical functions of a single reference substance; and by using the assumptions of the cell model, these functions are related to thermodynamic properties. The first approximations for the thermodynamic functions of ordering are discussed for a certain class of mixtures, and it is shown that although ordering effects are small in mixtures of molecules of equal size, they can be large when the molecules differ in size. The equations are used to calculate the ordering effects in liquid mixtures of carbon monoxide and methane. A.

530.162 : 530.145

9554. USE OF FIELD THEORY TECHNIQUES IN QUANTUM STATISTICAL MECHANICS. D.J.Thouless.
Phys. Rev., Vol. 107, No. 4, 1162-3 (Aug. 15, 1957).

It is shown that the normal product in quantum statistical mechanics, as defined by Matsubara (Abstr. 6397/1956), has zero expectation value. Another method for the treatment of the Bose particles is given. A.

MECHANICAL MEASUREMENTS 531.7

531.719.33 : 621.317.39

9555. A METHOD FOR THE REMOTE MEASUREMENT OF LIQUID DEPTH. M.A.Bullen and B.S.Brunsden.
Brit. J. Radiol., Vol. 30, 333-4 (June, 1957).

The method consists of measuring the change in capacitance of a multiple-plate condenser standing in the liquid. Difficulties involved in the use of various other methods are discussed briefly. J.J.Wilkins

MECHANICS OF FLUIDS 532

532.122

9556. COMPRESSIBILITIES OF MINERAL ACIDS. J.Bhimasenachar and S.V.Subrahmanyam.
J. Acoust. Soc. Amer., Vol. 29, No. 8, 899-901 (Aug., 1957).

Adiabatic and apparent molar compressibilities of aqueous

solutions of three mineral acids (HCl, HNO_3 and H_2SO_4) were studied over a wide range of concentrations, using the Debye–Sears diffraction effect. A new type of crystal holder suitable for work with acids is described. The results are discussed in terms of the Debye–Hückel theory. A.

532.13 : 533.16 : 536.22/.23

9557. SOME RELATIONSHIPS FOR VISCOSITY AND THERMAL CONDUCTIVITY OF LIQUIDS AND GASES. I.I.Novikov.
Atomnaya Energiya, Vol. 2, No. 5, 468-9 (1957). In Russian.

The viscosity coefficients of the liquid and saturated vapour phases (μ' and μ'' respectively) near the critical point (t_{kp}) for CO_2 appear to follow the equation $1/\mu' + 1/\mu'' = 6330 + 13\,(t_{kp}-t)$ where t is the temperature in °C. It is stated that a similar relationship of the form $1/\lambda' + 1/\lambda'' = 2/\lambda + b(t_{kp}-t)$ may be true for thermal conductivity (λ', λ'' thermal conductivity coefficients, λ and b constants). L.Bovey

532.14

9558. ALL METAL APPARATUS FOR THE DETERMINATION OF THE DENSITY OF LIQUEFIED GASES. R.L.Jarry.
Rev. sci. Instrum., Vol. 28, No. 8, 641-2 (Aug., 1957).

The metal construction enables its use with corrosive materials, and also allows measurements to be made at moderate pressures. It consists of a pyconmeter, temperature control device and gas handling system. While this apparatus was particularly designed for density work it was used for vapour pressure determinations with slight modification. The design and construction is given in detail and its use with liquid fluorine is outlined. A.

532.5

9559. ON HYDRODYNAMICAL FLUCTUATIONS.
L.D.Landau and E.M.Lifshits.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 618-19 (1957). In Russian.

Evaluates the first and second moments of the hydrodynamical variables under the effect of a small perturbation applied to the standard equations. J.W.Gardner

532.529

9560. DISTORTION OF FLUID DROPS IN THE STOKESIAN REGION. F.H.Garner, K.B.Mathur and V.G.Jenson.
Nature (London), Vol. 180, 331-2 (Aug. 17, 1957).

The circulation inside drops moving in a viscous medium has been studied. With some systems, such as carbon tetrachloride in glycerol (I), circulation begins at a much lower Reynolds number than in others, such as water in castor oil (II). For II the drops have the normal tailing shape at the onset of circulation whereas for I the drop remains spherical till the Reynolds number is about 0.1 and then it develops a cavity on top. An explanation is advanced in terms of the relative change in the outside hydrodynamic pressure and the inside pressure due to circulation. S.J.Gregg

CAPILLARITY 532.6

532.612.4

9561. THE SURFACE TENSION OF LIQUID SULFUR.
K.Ono and T.Matsushima.
Sci. Rep. Res. Insts Tôhoku Univ. A, Vol. 9, No. 4, 309-18 (Aug., 1957).

The experimental work was done by the maximum bubble pressure and the pendent-drop method in the temperature range between 120 and 420° C. The effects of arsenic and selenium were noted in the measurement. A.

532.64.08

9562. APPARATUS FOR THE MEASUREMENT OF SMALL CONTACT ANGLES BETWEEN LIQUIDS AND SOLIDS.
A.L.Speece, C.P.Rutkowski and G.L.Gaines, Jr.
Rev. sci. Instrum., Vol. 28, No. 8, 636-7 (Aug., 1957).

A device for the precise measurement of small ($< 10°$) liquid–solid contact angles is described. The technique is a variation of the tilting-plate method. Measurements of the contact angle of benzene on polyethylene at 25° C indicate that a precision of ±0.1 deg. is readily attainable. A.

MOLECULAR THEORY OF LIQUIDS 532.7

532.7

9563. TRANSPORT PROCESSES IN MULTICOMPONENT LIQUIDS. B.R.Sundheim.
J. chem. Phys., Vol. 27, No. 3, 791-5 (Sept., 1957).

The phenomenological equations are obtained for interacting flows of matter, electricity and heat. The differential equations of motion of these systems are written down and transformations which effect separation of variables are found, permitting exact integrations to be performed. An examination is made of coefficients of transport and the significance of a reference species is discussed. A.

532.72

9564. VALIDITY OF NERNST–EINSTEIN AND STOKES–EINSTEIN RELATIONSHIPS IN MOLTEN $NaNO_3$. L.Yang.
J. chem. Phys., Vol. 27, No. 2, 601-2 (Aug., 1957).

Existing measurements of the self-diffusion coefficients, D(Na) and $D(NO_3)$, of sodium and nitrate radicals are compared with the electrical conductivity using the Nernst–Einstein relation. The sum $D(Na)+D(NO_3)$ is less than expected. This is explained by the occurrence of electrically neutral molecules which contribute to the diffusion but not to the conductivity. The deduced diffusion coefficients for the free ions, Na^+ and NO_3^-, are in agreement with values calculated from the Stokes–Einstein equation relating diffusion coefficient to viscosity. A.B.Lidiard

532.73

9565. STRUCTURE IN IONIC SOLUTIONS. I.
G.W.Brady and J.T.Krause.
J. chem. Phys., Vol. 27, No. 1, 304-8 (July, 1957).

X-ray diffraction studies were made of concentrated KOH and KCl solutions. The radial distribution function for KOH indicates that the hydration number of K^+ is 4, in agreement with the theoretically calculated value of Bernal and Fowler. It appears that K^+ which is close in size to the H_2O molecule enters substitutionally into the pseudostructure of H_2O without disturbing the structure to any marked extent. The quantitative evaluation of the data on KCl solutions is more difficult because the first peak in the distribution function is not symmetrical. However, the results indicate that the Cl^- ion disrupts the H_2O structure and leads to an increase in the number of H_2O nearest neighbours. A.

532.73

9566. MODEL FOR METAL AMMONIA SOLUTIONS. J.Jortner.
J. chem. Phys., Vol. 27, No. 3, 823-4 (Sept., 1957).

Potential functions are given for an improved form of the electron cavity model for metal–ammonia solutions, based on Landau's electron capture model, in which the potential well is formed by the polarization of the medium by the electron itself. Numerical calculations of the stationary states and allowed transitions give values which agree with spectroscopic observations. A.J.Mee

532.739 : 532.5

9567. DISPERSION OF SOLUBLE MATTER IN FLOW THROUGH GRANULAR MEDIA. M.J.Beran.
J. chem. Phys., Vol. 27, No. 1, 270-4 (July, 1957).

It is supposed that the solvent is flowing slowly through a one dimensional tube filled with granular media, with mean velocity $\bar{v}$, and it is desired to find the future concentration pattern of the soluble matter. It is found that after a long time an initially thin slug of soluble matter is normally distributed about the position $\bar{v}t$ and that its standard deviation is proportional to $t^{1/2}$. It is further shown when this effect need not be considered in ion-exchange problems. A.

532.785 : 535.375.55

STRUCTURE OF THE MOTHER SOLUTION OF AN IONIC CRYSTAL. See Abstr. 6037

MECHANICS OF GASES 533

533.16 : 536.22/.23 : 532.13

VISCOSITY AND THERMAL CONDUCTIVITY OF LIQUIDS AND GASES. See Abstr. 9557

533.6.011.5 : 535.417

METHODS OF INTERFEROMETRY APPLIED TO THE VISUALIZATION OF FLOWS IN WIND TUNNELS. See Abstr. 9115

MOLECULAR THEORY OF GASES 533.7

533.7

9568. CONVEX MOLECULES IN NON-UNIFORM GASES, — SUPPLEMENT. T.Kihara and A.Ouchi.
J. Phys. Soc. Japan, Vol. 12, No. 9, 1052 (Sept., 1957).
See Abstr. 8461 (1957).

533.7

9569. ON FLUCTUATIONS IN A GAS. B.B.Kadomtsev.
Zh. éksper. teor. Fiz., Vol. 32, No. 4, 943-4 (1957). In Russian.

A study of the serial (lag) correlation of the position–velocity function for an ideal gas, subject to the assumption that the gas is sufficiently tenuous for encounters involving three or more molecules to be neglected. N.L.Johnson

533.7

9570. THE THERMODYNAMICS OF IRREVERSIBLE PROCESSES AS APPROXIMATION TO THE ENSKOG THEORY OF GASES. II. MULTI-COMPONENT SYSTEMS. H.G.Reik.
Z. Phys., Vol. 148, No. 3, 333-54 (1957). In German.

For Pt I see Abstr. 7840 (1957). It is shown that the kinetic description of irreversible processes (including chemical reactions) is equivalent to the thermodynamic treatment, provided that the distribution function is sufficiently well approximated by the first two terms of Enskog's solution. Treatment of the collision integral, which depends on a particular model of molecular interaction, is avoided so that the result is generally applicable. R.Stratton

VIBRATIONS. ACOUSTICS 534

534.2

9571. COMMENTS ON A RECENT PAPER BY DERESIEWICZ ON PLANE WAVES IN A THERMOELASTIC SOLID. M.Greenspan.
J. Acoust. Soc. Amer., Vol. 29, No. 8, 966 (Aug., 1957).

Deresiewicz (Abstr. 4051/1957) refers to the fallacy in Laplace's argument regarding the adiabicity of sound propagation at ordinary frequencies. Greenspan comments that several workers since the days of Lamb have shown that the speed of sound tends to the adiabatic value at zero frequency and to the isothermal value at infinite frequency in the case of a thermally conducting but perfectly inviscid extended medium. There are no perfectly inviscid media, and heat conduction without viscosity should not be considered because its effect on the viscothermal equations is to give a solution for which the speed of sound is infinity at infinite frequency. The errors made in assuming Laplace's argument are therefore not as large as is implied by Deresiewicz. H.J.H.Starks

534.22 . 534.23

9572. SOUND VELOCITY AND ATTENUATION IN BUBBLY MIXTURES MEASURED IN STANDING WAVE TUBES. E.Silberman.
J. Acoust. Soc. Amer., Vol. 29, No. 8, 925-33 (Aug., 1957).

Experimental measurements of sound velocity and attenuation constant in a mixture of air bubbles in fresh water, using a standing-wave tube, are described. Bubble sizes in the mixtures were controlled between about 0.08 and 0.26 in. diameter, concentrations ranged from 0.03 to 1%, and applied frequencies from 60 to 20 000 c/s. Bubbles in each mixture were of a single uniform size except for one series of experiments in which mixtures of bubbles of two discrete sizes were used. Attenuation constants were obtained for each mixture through a range of frequencies, including natural frequencies of the bubbles in the mixture. Velocity measurements were not obtained near the natural frequencies of the bubles because high attenuation prevented the establishment of standing waves. Data obtained in the tubes were reduced to mean, infinite conditions and compared with available theory. The measurements show that theory gives at least a good estimate of both velocity and attenuation constant in the region investigated. A.

534.222.2 : 538.566.2

9573. A RADIO METHOD OF DETERMINING THE VELOCITY OF A SHOCK WAVE. J.S.Hey, J.T.Pinson and P.G.Smith.
Nature (London), Vol. 179, 1184-5 (June 8, 1957).

A virtually continuous record of velocity relative to distance along the tube is obtained by measuring the change of frequency, due to Doppler effect, of radiowaves reflected from the shock front. A dipole, at the downstream end of the tube, is used to transmit and receive at a frequency such that the reflection coefficient is increased by ionization in the following flow. A typical frequency for shock Mach numbers exceeding 6 in argon is 5000 Mc/s. A directly calibrated oscillographic display is used. T.H.D.Attewell

534.23

9574. ON THE PROPAGATION OF ULTRASONIC WAVES OF FINITE AMPLITUDE IN LIQUIDS.
V.A.Krassilnikov, V.V.Shklovskaya-Kordy and L.K.Zarembo.
J. Acoust. Soc. Amer., Vol. 29, No. 5, 642-7 (May, 1957).

The dependence of the ultrasonic absorption coefficient on the intensity was measured in different liquids (water, ethyl and methyl ethers, toluene, transformer oil, and glycerine) by means of the thermal method (thermocouples). The measurements were made at 1.5 Mc/s with intensities of 0.3-9 W/cm^2. There was found a considerable increase of nearly two orders of magnitude in the absorption. Measurement at higher static pressures, up to 15 kg/cm^2, gives results which coincide within the range of error, with the results of the measurements at atmospheric pressure, suggesting that the influence of cavitation is small. Direct experimental observation of the harmonics in a travelling wave of finite amplitude was accomplished. The receivers were quartz plates with their fundamental frequencies equal to the frequencies of the harmonics; to remove standing waves between the receiver and the transducer, an acoustic filter was used, consisting of a thin plate "transparent" for the appropriate harmonic and opaque for the fundamental at a certain angle. Absolute measurement of the harmonic intensity was obtained by a radiometer which was placed behind the acoustic filter. A.

534.23

9575. ULTRASONIC PROPAGATION MEASUREMENT IN SEA WATER UP TO 400 kc. T.Hashimoto and Y.Kikuchi.
J. Acoust. Soc. Amer., Vol. 29, No. 6, 702-7 (June, 1957).

The propagation characteristics of ultrasound in sea water and its ultrasonic reflection loss on the sea bottom or on fish schools must be studied for both the design and the practical operation of echo sounders, fish finders, and SONAR's. This paper shows a practical method for this study, together with the results of measured propagation characteristics in both vertical and horizontal directions, as well as the ultrasonic reflection loss on the sea bottom and on fish schools, using 28, 50, 200, 300, and 400 kc/s. The propagation attenuation in a direction vertical to the sea surface is the result mainly of spherical divergence, but the attenuation in a horizontal direction is caused partly by absorption as well. This absorption becomes larger at higher frequencies: in fact, the results of experiments show that the absorption is 10-20 dB/km at 28 kc/s, 37-50 dB/km at 200 kc/s, and about 120 dB/km at 400 kc/s. The reflection loss of the ultrasound at a fish school decreases as frequency increases. On the contrary, the reflection loss of the sea bottom increases as frequency increases. At 200 kc/s, therefore, the echoes from ground fishes sometimes become stronger than that from the sea bottom. A.

534.23

9576. ON THE TRANSMISSION OF A SPHERICAL SOUND WAVE THROUGH A STRETCHED MEMBRANE. G.L.Lamb, Jr.
J. Acoust. Soc. Amer., Vol. 29, No. 10, 1091-5 (Oct., 1957).

The transmission of a spherical sound wave through a homogeneous stretched membrane of infinite extent is investigated theoretically. An integral representation of the transmitted sound field is initially derived. The path of integration is then transformed into the complex plane and the integration carried out in an approximate manner by the method of stationary phase. The transmitted sound field is found to be composed of two parts, an outgoing spherical wave modified by an amplitude factor containing angular dependence and a surface wave. The surface wave, which results from the free flexural vibration of the membrane itself, exhibits an interesting "zone of silence" in the transmitted sound field. A.

534.23

9577. INTERFEROMETRIC DETERMINATION OF ULTRASONIC ABSORPTION IN CASTOR OIL.
D.E.Schuele, F.A.Gutowski and E.F.Carome.
J. Acoust. Soc. Amer., Vol. 29, No. 10, 1081-5 (Oct., 1957).

Observations were made at 3 Mc/s over the temperature range from 10° to 45° C. An improved interferometer system which utilizes a liquid-to-air reflecting interface was employed, together with a simplified electrical detection circuit. The observed absorption is less than the classical values below 25°C, but greater at higher temperatures. In general, the results compare well with those obtained by other observers using different measuring techniques. A.

534.23 : 537.311.33

9578. ULTRASONIC ATTENUATION BY FREE CARRIERS IN GERMANIUM. G.Weinreich.
Phys. Rev., Vol. 107, No. 1, 317-18 (July 1, 1957).

The attenuation per unit length is given by encE/S (e = electronic charge, n = carrier density, c = wave velocity, E = acousto-electric field, S = power density of the wave) and is of order 10^{-21} n/λ at liquid-air temperature and 60 Mc/s ($\lambda/2\pi$ = acoustic wavelength). R.Stratton

534.23 : 538.65 : 539.11

PROPOSAL FOR DETERMINING THE FERMI SURFACE BY MAGNETO-ACOUSTIC RESONANCE. See Abstr.9769

534.231.3

9579. ACOUSTIC IMPEDANCE OF A HELMHOLTZ RESONATOR AT VERY HIGH AMPLITUDE.
D.A.Bies and O.B.Wilson, Jr.
J. Acoust. Soc. Amer., Vol. 29, No. 6, 711-14 (June, 1957).

The acoustic impedance of a Helmholtz resonator terminating a 10 in. diameter tube was investigated for sound pressure levels in the resonator of from 100 dB to 170 dB and for a range of particle velocities in the neck of from 1.3 cm/sec to 1.2 x 10^4 cm/sec (r.m.s.). Two different mounting orientations showed the same general rise in acoustic resistance and rise in resonant frequency with increasing sound pressure level but gave quite different results in detail. A.

534.232 : 537.365

9580. ELECTROKINETIC HYDROPHONE USED AT 9 kc.
W.Holak, E.Ackerman, H.L.Kinsloe and J.J.Reid.
J. Acoust. Soc. Amer., Vol. 29, No. 8, 909-15 (Aug., 1957).

The construction and testing are described of a hydrophone functional at 9 kc/s and depending for its response on an electro-kinetic effect. The use of the hydrophone in exploring the field of a Raytheon vibrator is discussed. A.

534.32 : 534.781

9581. BASIS FOR THE ACOUSTICAL STUDY OF SINGING.
D.B.Fry and L.Manén.
J. Acoust. Soc. Amer., Vol. 29, No. 6, 690-2 (June, 1957).

A systematic classification of the tones which singers produce is necessary as a basis for spectrographic and for X-ray studies of singing. A three-dimensional system is proposed in which tones are classified according to (1) the type of voice; (2) the mood which the singer expresses; and (3) the vowel which is articulated. Preliminary experiments suggest that acoustic differences (apparent in spectrograms) may be found regularly correlated with the differences of voice, mood and articulation covered by the system of classification. A.

534.322.1

9582. REGARDING THE SOUND QUALITY OF VIOLINS AND A SCIENTIFIC BASIS FOR VIOLIN CONSTRUCTION. H.Meinel.
J. Acoust. Soc. Amer., Vol. 29, No. 7, 817-22 (July, 1957).

Response curves, important both for steady sound and transients, give a far-reaching insight into the objective characteristics of violins: good ones exhibit large amplitudes at low frequencies and small ones at high frequencies, a broad minimum near about 1500 c/s, and larger amplitudes between about 2000 and 3000 c/s. The musical subjective significance of these physical properties is mentioned briefly. In general the sound pressure radiated from a violin follows the inverse-distance law, being independent of frequency. The influence of wood thickness is very important, that of the varnish is comparably small. Pine has a greater damping at high frequencies than at low frequencies. This seems to be a good acoustical reason for making important parts of stringed instruments of pine. Sapwood is better than heartwood. Similarly, some kinds of varnish produce more damping at high frequencies than at low frequencies. If a resonance curve is to be imitated in detail, it is necessary to change carefully the wood thickness of certain parts of the violin body. The applicability of present day scientific knowledge to the construction of violins is here outlined. A.

534.39

9583. ACOUSTICAL RADIATION PRESSURE DUE TO INCIDENT PLANE PROGRESSIVE WAVES ON SPHERICAL OBJECTS.
G.Maidanik.
J. Acoust. Soc. Amer., Vol. 29, No. 6, 738-42 (June, 1957).

The expression for the force exerted on a scattering sphere by a plane progressive wave is computed by making use of the general formulation derived by Westervelt (Abstr. 4086/1957). The expression is general in the sense that it allows for complex refractive index and variation of the relative effective densities of the sphere to that of the surrounding medium. The numerical calculations are confined to the case of "hard" and "soft" spheres only. A.

534.39

9584. ACOUSTICAL RADIATION PRESSURE DUE TO INCIDENT PLANE PROGRESSIVE WAVES ON SPHERICAL OBJECTS. G.Maidanik and P.J.Westervelt.
J. Acoust. Soc. Amer., Vol. 29, No. 8, 936-40 (Aug., 1957).

The expression for the force exerted on a "rigid" sphere by a plane progressive wave is computed by making use of the momentum formulation. The expression is general in the sense that it allows for variation of the density of the sphere relative to that of the surrounding medium, as well as for a wide range of ka (k = wave-number, a = radius of sphere). The numerical calculations are confined to the range ka ≤ 10. A.

534.39

9585. ACOUSTIC TORQUES AND FORCES ON DISKS.
J.B.Keller.
J. Acoust. Soc. Amer., Vol. 29, No. 10, 1085-90 (Oct., 1957).

The time-average forces and torques exerted by a plane sound wave upon fixed rigid disks of various shapes are calculated. Results are given for disks bounded by smooth closed convex curves. These results are then specialized to ellipses and circles. Results are also given for infinitely long thin strips. The results are all valid for ka large, where $k = 2\pi/\lambda$, λ being the wavelength and a being a typical dimension of the disk. The oscillatory behaviour of the torque as a function of ka and the occurrence of numerous equilibrium positions are interesting consequences of these calculations. A.

534.7

PHYSIOLOGICAL ACOUSTICS. HEARING. See also under "Medical science. Human physiology". Decimal classification 612.85

534.77

9586. RECORDED GROUP AUDIOMETER TEST COMPARISONS AT THE 1956 SOUTHERN CALIFORNIA EXPOSITION.
J.C.Webster and P.O.Thompson.
J. Acoust. Soc. Amer., Vol. 29, No. 8, 895-9 (Aug., 1957).

Recorded series of 4000 c/s absolute threshold tests were administered over earphones to 1919 people in groups of 8 or less. The results suggest that: (1) test–retest reliability is increased by increasing the number of attenuation steps within a given hearing loss (HL) range; (2) use of fewer and larger steps tends to make HL scores larger; (3) warble-tones are interchangeable with pure tones as test stimuli; and (4) left ears tend to show greater HL. The results of this survey for HL as a function of age agree reasonably well with results of other recorded-test hearing surveys, but not so well with survey results obtained with clinical audiometers. A.

534.78

9587. PROBLEMS OF SPEECH COMMUNICATION (DEALT WITH AT THE SECOND INTERNATIONAL ACOUSTICS CONGRESS IN CONJUNCTION WITH A SEMINAR ON SPEECH COMMUNICATION).
W.Endres.
Nachrichtentech. Z. (N.T.Z.), Vol. 10, No. 2, 74-80 (Feb., 1957).
In German.

Gives brief reports of the many sittings which were held. A film made in the Haskins Laboratory showed X-rays of the larynx and vocal tract during speech, and demonstrated the function of the nose, mouth, and throat cavities. Acoustic and electric models of the vocal tract have been made to produce speech to a high degree of naturalness. Several band-compression systems were described in which parameters of speech were transmitted. Other subjects dealt with were: stop consonants, linguistics and communication theory, speech analysis, whispered speech, phonemic transitions, and development of speech writers. D.J.Hall

OPTICS. RADIATION. SPECTRA 535

535.14

9588. CORRELATION BETWEEN PHOTONS, IN COHERENT BEAMS OF LIGHT, DETECTED BY A COINCIDENCE COUNTING TECHNIQUE. R.Q.Twiss, A.G.Little and R.H.Brown.
Nature (London), Vol. 180, 324-6 (Aug. 17, 1957).

A new experiment is carried out to test the existence of a correlation between photons from a coherent beam of light. By employing a source of narrow line-width (Hg 198) it is shown that the arrival times of photons at different points are correlated when these points are illuminated by coherent light beams. The experimental and theoretical values for the number of photoelectrons which are correlated are in satisfactory agreement. S.Tolansky

535.14 : 539.11

9589. A CORRECTION TO THE PAPER "DISPERSION FORMULAE OF QUANTUM OPTICS OF METALS IN THE MANY-ELECTRON THEORY". A.V.Sokolov and V.I.Cherepanov.
Zh. éksper. teor. Fiz., Vol. 32, No. 4, 949-50 (1957). In Russian.

Errors in the above paper (Abstr. 7225/1955) are rectified and corrected formulae for σ and ϵ are given. S.Chomet

535.223 : 535.331

VELOCITY OF LIGHT DERIVED FROM A BAND SPECTRUM METHOD. See Abstr. 9065

535.241.33 : 621.326.72

9590. THE AGEING OF GASFILLED STANDARD LAMPS ON A.C. AND D.C. W.Barnett, R.G.Berry and J.S.Preston.
Brit. J. appl. Phys., Vol. 8, No. 9, 363-6 (Sept., 1957).

A comparison is made of the rates of fall of light output and current, at constant voltage, and colour temperature 2700°K approx., of 100-110 V 100 W gas-filled photometrix standard lamps, on a.c. and d.c. supplies. The rates are appreciably greater on d.c. than on a.c., and this is shown to be due to specific effects of d.c.-operation on filament resistance, and filament emissivity. These effects are shown to be fully reversible, after many hours of burning, by reversal of the d.c. polarity, and not inconsistent with migration of tungsten along the surface of the filament. A practical conclusion is that the usefully smaller rate of depreciation characteristic of a.c.-operation may be fully retained on d.c. by reversal of polarity at regular convenient intervals. An a.c. supply, with its easy voltage regulation, is then legitimate for burning the lamps for the lengthy periods of the normal preliminary ageing tests. A.

535.317.9

9591. NOTE ON THE WASSERMAN–WOLF METHOD FOR DESIGNING ASPHERIC SURFACES. E.M.Vaskas.
J. Opt. Soc. Amer., Vol. 47, No. 7, 669-70 (July, 1957).

An extension of this method (Abstr. 944/1949), in which a system of first-order linear differential equations is solved to determine the forms of two aspherics. Axial stigmatism and any specified departure from the sine condition may be obtained.

W.Weinstein

535.321

9592. MEASURING REFRACTIVE INDEX OF PLASTIC FILMS. R.H.Ellis, Jr.
Rev. sci. Instrum., Vol. 28, No. 7, 557-8 (July, 1957).

By a method of successive approximation the index of refraction of polystyrene films was determined from two photographs of continuous spectra. It is shown that the method is valid if the dispersion is known within several percent as a starting assumption. A.

535.327

9593. ADIABATIC PIEZO-OPTIC COEFFICIENT OF HEAVY WATER. C.K.Narayanaswamy, P.S.Narayanan and R.S.Krishnan.
Nature (London), Vol. 180, 497-8 (Sept. 7, 1957).

Values of the adiabatic piezo-optic (variation of refractive index with pressure) coefficient, refractive index and its temperature variation, density, cubical expansion, specific heat at constant pressure and compressibility are given for ordinary and heavy water. The failure of the Lorenz–Lorentz formula to account for the observed piezo-optic effects is demonstrated and the importance of the anisotropy of the polarization field and consequent changes in the molecular polarizability is emphasized. E.A.Mussett

535.33 : 537.525

SPECTRA OF POSITIVE COLUMNS IN DISCHARGES. See Abstr. 9706

535.33.07

9594. 6.8-METER GRAZING INCIDENCE VACUUM SPECTROGRAPH. R.K.Brehm and G.Benzie.
Rev. sci. Instrum., Vol. 28, No. 7, 552-7 (July, 1957).

Technical design and construction details for this spectrograph are discussed. The spectrograph is built into a 30 in. by 12 ft tube evacuated by a high-speed pumping system capable of evacuation from atmospheric pressure to 5×10^{-5} mm in thirty minutes. Operating at an incidence angle of 82°, a spectral range from 50 to 2000 A is covered in steps on a 30 in. plateholder. Provision is made for changing entrance-slit widths quickly and easily through rotary vacuum seals. The wavelength region may be changed from outside the instrument while under vacuum. Spectra from 540 to 1800 A are shown. A.

535.331 : 537.523.5

9595. INVESTIGATION OF TIME VARIATION OF EMISSION SPECTRUM OF AN ALTERNATING-CURRENT ARC.
V.V.Lebedeva and R.A.Milovidova.
Optika i Spektrosk., Vol. 2, No. 2, 150-9 (1957). In Russian.

The intensities and temperatures of Cu I, Ca I and II lines from carbon and aluminium electrodes were measured as a function of time. A phase lag (dependent on the electrode material) between the maximum intensity and temperature was found. A comparison is made between these temperatures and those measured without a time-resolution apparatus. L.Bovey

535.331

9596. THE SPECTRUM OF IONIZED URANIUM.
N.G.Morozova and G.P.Startsev.
Optika i Spektrosk., Vol. 2, No. 3, 382-4 (1957). In Russian.

The spark discharge from U_3O_8 on copper electrodes was examined with a quartz spectrograph in the region 2400-3500 A and the intensities of lines measured for different inductances (5-1000 μH) in the circuit. From a comparison of the variation in line intensities with inductance for both U, and Cu, Cu^+ and Cu^{++} lines it is concluded that most of the U lines excited in the discharge belong to U^{++}. L.Bovey

535.332 : 539.153.4

ELECTRON COLLISION EXCITATION OF Hg SPECTRUM. See Abstr. 9340

535.333 : 535.343 : 535.37

9597. MIRROR SYMMETRY AND SHAPE OF ABSORPTION AND LUMINESCENCE BANDS IN COMPLEX MOLECULES.
L.P.Kazachenko and B.I.Stepanov.
Optika i Spektrosk., Vol. 2, No. 3, 339-49 (1957). In Russian.

Formulae based on radiation laws are derived connecting absorption coefficients, luminescent power and emission in molecular spectra. Data on various substituted phthalimides are used to illustrate applicability of these formulae. L.Bovey

535.333

9598. BANDS INDUCED BY PRESSURE NEAR TO THE RESONANCE LINES OF MERCURY IN EMISSION IN THE PRESENCE OF RARE GASES. S.Robin and St.Robin.
J. Phys. Radium, Vol. 18, No. 6, 411-12 (June, 1957). In French.

Bands thought to be due to Hg–rare-gas complexes were photographed in emission, in the neighbourhood of the 2536 and 1849 A lines of mercury, for all the rare gases. A mercury discharge containing the gases, at pressures from 3 to 15 cm Hg was used. R.W.Nicholls

535.333

9599. EMISSION OF A BAND SPECTRUM OF NITROGEN UNDER PRESSURE. Y.Leycuras.
J. Phys. Radium, Vol. 18, No. 7, 476 (July, 1957). In French.

The spectra of non-condensed discharges through N_2 at pressures ranging from atmospheric to 150 kg/cm² consist of bands of the second positive system of N_2 and the most intense bands of the first negative system of N_2^+. The relative intensity of the N_2^+ bands appear to be favoured relative to those of N_2 with increase in pressure. Observations were made upon the changes in vibrational and rotational structure with pressure. R.W.Nicholls

535.333

9600. THE EMISSION SPECTRUM OF ALUMINUM MONOCHLORIDE IN THE VACUUM ULTRAVIOLET.
S.P.Reddy and P.Tiruvenganna Rao.
Canad. J. Phys., Vol. 35, No. 8, 912-17 (Aug., 1957).

The spectrum of aluminium monochloride as excited in a high-frequency discharge was photographed using a normal incidence grating spectrograph. Six brief new systems of bands were obtained in the region λλ2075-1820, in addition to three characteristic continua on the longer wavelength side of the discrete systems. The analyses of five of these systems indicate a common lower level which is identified as the ground state of the AlCl molecule. For the remaining system, only the upper state vibrational frequency ω_e' is derived. All these systems involve six new, hitherto unknown, excited electronic states of the AlCl molecule. The spectrum, when excited in a condensed discharge from a high-voltage transformer through steaming $AlCl_3$ vapour, is found to consist of numerous discrete emission bands in the region λλ2365-2020. These bands are different from those occurring in the high-frequency discharge. Because of overcrowding of these bands, owing possibly to lack of adequate dispersion, no analysis is presented. A.

535.333

9601. THE EMISSION SPECTRUM OF THE PH^+ MOLECULE.
N.A.Narasimham.
Canad. J. Phys., Vol. 35, No. 8, 901-11 (Aug., 1957).

A system of three red-degraded bands at 3854, 4228, and 3567 A were obtained in emission from a hollow cathode discharge through helium containing a little phosphorus vapour and hydrogen. Rotational analyses of the bands show that they are the 0-0, 0-1 and 1-0 bands of a $^2\Delta - ^2\Pi$ transition of the PH^+ molecule. The $^2\Delta$ state is regular with small spin splitting (case b) while the $^2\Pi$ state is regular with large spin splitting (case a). For $v = 0$, the F_1 levels of the $^2\Delta$ state with $N \geqq 13$ and the F_2 levels with $N \geqq 15$ are predissociated. Also the lines arising from the F_1 levels of the $^2\Delta$ state with $v = 1$ are

found to be extremely weak compared to those arising from the F_3 levels. Vibrational and rotational constants are determined and the dissociation energy is found to be 3.06 ± 0.25 eV. A.

535.333

9602. THE SPECTRUM OF THE P_2^+ MOLECULE.
N.A.Narasimham.
Canad. J. Phys., Vol. 35, No. 10, 1242-9 (Oct., 1957).

Two band systems attributed to the P_2^+ molecule were excited in a hollow-cathode discharge tube. The first of these is a $^2\Pi-^2\Pi$ band system lying in the region 3400-3850 A. The lower state of this system probably is the ground state of the P_2^+ molecule. The second system is a $^2\Sigma-^2\Sigma$ system lying in the region 3900-4400 A. High-resolution spectra of both the band systems have been analysed and the rotational and vibrational constants determined. A.

535.333

9603. INFRARED SPECTRUM OF THE TWO-STAGE COOL FLAME OF ACETALDEHYDE. R.E.Donovan.
J. chem. Phys., Vol. 27, No. 1, 324-6 (July, 1957).

The emission and absorption are plotted from 3-12 μ at various heights above a flat-flame burner. Bands of CO_2, CO, H_2O, CH_4 and H_2CO are strong. Those of acetaldehyde itself persist for some distance. This contrasts with the diethyl ether flame from which bands of ether disappear quickly. The C_2H_4 bands are much weaker in the acetaldehyde flames than in that of ether. Reaction processes are briefly discussed. A.G.Gaydon

535.337

9604. THE MECHANISM OF PARTICLE INTERACTION IN DISCHARGE PLASMA. E.F.Kozyreva.
Optika i Spektrosk., Vol. 2, No. 1, 43-8 (1957). In Russian.

The spectral widths of two Na I and one Li I line (4983 A, 4669 A, and 4603 A respectively)excited in an a.c. arc were measured on a grating instrument (5 A/mm dispersion). The results were examined using two assumptions: linear or quadratic Stark effect; the first and second lines showed good agreement with the former and latter assumptions respectively whilst the third involved a summation of both. L.Bovey

535.338.332 : 537.525

9605. INVESTIGATION OF SELF-ABSORPTION PHENOMENON IN HYPERFINE STRUCTURE COMPONENTS. Yu.I.Turkin.
Optika i Spektrosk., Vol. 2, No. 3, 290-7 (1957). In Russian.

The effect of discharge conditions in a hollow cathode on the line intensity was studied. Tl, Cu and Kr lines were examined (especially the Tl resonance lines) on a Fabry–Perot interferometer. Intensities of hyperfine structure components differed from those theoretically expected and self-absorption effects are discussed as a partial explanation. L.Bovey

535.338.332 : 539.153.4

9606. DETERMINATION OF THE QUADRUPOLE INTERACTION CONSTANTS FOR THE U^{233} ISOTOPE BY OPTICAL ATOMIC SPECTROSCOPY. N.M.Yashin.
Optika i Spektrosk., Vol. 2, No. 4, 409-16 (1957). In Russian.

The hyperfine structure of U^{233} lines (13 arc, 17 spark) were studied by means of a Fabry–Perot etalon of 88% reflecting power. All lines showed the six components expected. A study of both the intensities of and the intervals between components gave the contribution from the ground state levels $^6L_{11/2}$ and $^6L_{13/2}$ to the observed hyperfine structure. Numerical values for the quadrupole interaction constants for these two levels were calculated from the data and were $(-5.5 \pm 1.5) \times 10^{-5}$ and $(-1.7 \pm 0.7) \times 10^{-5}$ cm^{-1} respectively. L.Bovey

535.343

9607. ON THE PRESSURE BROADENING IN THE GAMMA BANDS OF NITRIC OXIDE. W.R.Thorson and R.M.Badger.
J. chem. Phys., Vol. 27, No. 3, 609-11 (Sept., 1957).

A quantitative reinvestigation of the pressure broadening in the $\gamma(0,0)$ and $\gamma(1,0)$ bands of nitric oxide establishes that the pressure effect is not abnormal as has sometimes been supposed and that the collision diameter of the excited NO molecule is approximately 3.8 A. A.

535.343

9608. ULTRAVIOLET ABSORPTION SPECTRA OF HCN AND DCN. I. THE $\alpha-X$ AND $\beta-X$ SYSTEMS.
G.Herzberg and K.K.Innes.
Canad. J. Phys., Vol. 35, No. 8, 842-79 (Aug., 1957).

Four band systems were found of which two, $\alpha-X$ and $\beta-X$, are described and analysed. A.

535.343

9609. FLASH SPECTROSCOPY OF RADICALS IN THE SHOCK TUBE. C.E.Campbell and I.Johnson.
J. chem. Phys., Vol. 27, No. 1, 316-17 (July, 1957).

Absorption spectra of radicals formed in the wake of shock waves propagated through benzene, acetaldehyde, and propane (in argon–oxygen mixtures) were photographed using a flash tube as a source of continuum. Spectra of C_2, CH, OH, CN are reported. The benzene absorption at 2500 A appears to broaden into a continuum as the temperature rises. R.W.Nicholls

535.343

9610. THE ABSORPTION SPECTRA OF RUBY.
Y.Tanabe and S.Sugano.
J. Phys. Soc. Japan, Vol. 12, No. 5, 556 (May, 1957).

The spectrum has bands at 18 000 and 25 000 cm^{-1} and groups of lines at 14 000 and 21 000 cm^{-1}. The interpretations of the sharp lines, the dichroism and the Zeeman patterns are discussed briefly. G.F.Lothian

535.343

9611. THE OPTICAL ABSORPTION OF $Ni^{2+}.6H_2O$ AT LOW TEMPERATURES. R.Pappalardo.
Nuovo Cimento, Vol. 6, No. 2, 392-4 (Aug., 1957).

On cooling $NiSiF_6.6H_2O$ to 20°K and 4°K the main band in the visible spectrum shifted its peak from 25 500 cm^{-1} at room temperature to 26 500 cm^{-1},and absorption lines appeared, which were obscured at room temperature by thermal agitation. An interpretation is attempted in terms of ligand field theory. B.T.M.Willis

535.343 : 535.37

9612. CALCULATION OF THE LUMINESCENCE SPECTRA OF CRYSTAL PHOSPHORS. N.D.Potekhina.
Optika i Spektrosk., Vol. 2, No. 3, 388-92 (1957). In Russian.

Absorption and emission bands of silver-activated NaCl crystals are calculated using a method similar to that used by Williams for KCl:Tl (Abstr. 4293/1951, 10964/1954). The values obtained are in agreement with experiment if the observed bands can be regarded as corresponding to the transition $^3P_1-^1S_0$ in the silver ion. Further experiments are necessary to elucidate the latter point. S.Chomet

535.343 : 539.371

9613. THE INFLUENCE OF DEFORMATION ON CRYSTAL SPECTRA. V.L.Broude, O.S.Pakhomova and A.F.Prikhot'ko.
Optika i Spektrosk., Vol. 2, No. 3, 323-9 (1957). In Russian.

Thin layers of benzene, anthracene, naphthalene and CdS held between two plates were examined at 20.4°K. Absorption and polarization measurements were made and a short discussion of the spectral shift and changes in band diffuseness given. L.Bovey

535.343

9614. THE ELECTRONIC ABSORPTION SPECTRUM OF NAPHTHOTRIAZINES. M.Simonetta, G.Favini and V.Pierpaoli.
Nuovo Cimento (Ser. 10), Vol. 5, No. 6, 1814-16 (June, 1957).

Presents results of experiments and theoretical analysis similar to those on benzotriazines (Abstr. 4148/1957). J.Hawgood

535.343 : 539.132

9615. INFRARED SPECTRUM AND FORCE CONSTANTS OF THE NITRITE ION. R.E.Weston, Jr and T.F.Brodasky.
J. chem. Phys., Vol. 27, No. 3, 683-9 (Sept., 1957).

The infrared spectra of the following compounds were investigated: microcrystalline $NaNO_2$, KNO_2, and $AgNO_2$; and aqueous solutions of $NaNO_2$ and KNO_2. The spectra of N^{15}-labelled compounds were also obtained. The spectrum of the high-temperature modification of $NaNO_2$, which exists above 160°, was observed. The fundamental frequencies for NO_2^- (in crystalline $NaNO_2$) are: $\nu_1(a_1) = 1328 \pm 2$ cm^{-1} (N^{14}), 1303 ± 2 (N^{15}); $\nu_2(a_1) = 828.2 \pm 0.4$ (N^{14}), 823.6 ± 0.4 (N^{15}); $\nu_3(b_1) = 1261 \pm 3$ (N^{14}). These are used to calculate the following force constants, in units of millidynes/A: $f_d = 7.69 \pm 0.10$, $f_\alpha/d^2 = 1.75 \pm 0.04$, $f_{dd} = 1.94 \pm 0.13$, $f_{d\alpha}/d = 0.505 \pm 0.113$. A.

535.343 : 535.375.5

9616. INFRARED AND RAMAN SPECTRA OF PHOSPHORUS PENTACHLORIDE. J.K.Wilmshurst and H.J.Bernstein.
J. chem. Phys., Vol. 27, No. 3, 661-4 (Sept., 1957).

The infrared spectrum of PCl_5 in the vapour state and as a solution in CS_2 was obtained. The Raman spectrum of a solution of PCl_5 in benzene was obtained photoelectrically together with depolarization ratios. A complete vibrational assignment is made on the basis of D_{3h} symmetry, and force constants were calculated. Thermodynamic functions are computed from the assigned fundamentals and used to interpret the equilibrium of the reaction $PCl_3(g) + Cl_2(g) = PCl_5(g)$ giving $\Delta E_0^0 = -20\,525 \pm 160$ cal mole^{-1}. A.

535.343 : 548.736.4

INFRARED ANALYSIS OF IRON TETRACARBONYL. See Abstr. 9467

535.343

9617. HYDROGEN VIBRATION SPECTRA OF ROCHELLE SALT. A.N.Baker and D.S.Webber.
J. chem. Phys., Vol. 27, No. 3, 689-92 (Sept., 1957).

The polarized infrared spectra of Rochelle salt from 4550 cm^{-1} to 8100 cm^{-1} were observed with a grating spectrometer. These spectra and the Raman spectra reported by other authors are partially interpreted. Tentative conclusions concerning the location of the hydrogen atoms in the crystal at a temperature of 300°K are drawn from the analysis of the spectra. A.

535.343 : 535.375.5

9618. RAMAN AND INFRARED INTENSITIES IN THE VIBRATIONAL SPECTRA OF HYDROCARBONS. I. SKELETAL VIBRATIONS OF STRAIGHT ZIGZAG CHAINS. O.H.Theimer.
J. chem. Phys., Vol. 27, No. 2, 408-16 (Aug., 1957).

The vibrational frequencies and normal coordinates of finite, straight, zigzag chains are calculated from an Urey–Bradley potential, the boundary effects being taken into account by a perturbation method. The dominant perturbation terms fall off with $1/N^2$ (N = number of C atoms) and are found to be negligible for $N > 5$. The intensities of infrared and Raman bands are calculated without using the simplifications implied in "bond moment" and "bond polarizability" theories. All the vibrations are found inactive as fundamentals in infrared absorption. The Raman active vibrations produce branches of lines with relative intensities approximately 1, 1/9, 1/25..., $1/N^2$ and with line spacing rapidly decreasing with increasing N. The strong Raman line observed near 890 cm^{-1} cannot be assigned to a vibration of the carbon skeleton. One low-frequency vibration ($\nu \sim 1150/N$ cm^{-1}) perpendicular to the molecular plane should be Raman active. Its low intensity (it has not been observed so far) indicates cylindrical symmetry of the polarizability about the molecular axis. A.

535.343 : 539.132

9619. VIBRATIONAL SPECTRA OF FLUORINATED AROMATICS. XIII. BENZOTRIFLUORIDE.
N.A.Narasimham, J.R.Nielsen and R.Theimer.
J. chem. Phys., Vol. 27, No. 3, 740-5 (Sept., 1957).

For Pt XII, see Abstr. 1182 (1957). The infrared absorption spectrum of gaseous benzotrifluoride was obtained with a 1 m cell and with NaCl and CsBr prisms. The Raman spectrum of liquid $C_6H_5CF_3$ was photographed and depolarization ratios measured for most of the Raman bands. Under the assumptions that the molecule has approximately the symmetry C_{2v} and that phenyl and CF_3 vibrations are weakly coupled, all but three of the vibrational fundamentals are assigned and classified. A.

535.343

9620. INFRARED INTENSITY OF THE C–H STRETCHING BAND OF CHLOROFORM IN SOME HALOGENATED ACETONES. R.E.Kagarise.
J. chem. Phys., Vol. 27, No. 3, 827-8 (Sept., 1957).

535.343.9 : 535.375.5

9621. ABSOLUTE RAMAN INTENSITIES. D.H.Whiffen.
J. Opt. Soc. Amer., Vol. 47, No. 6, 568-9 (June, 1957).

The absolute values of the polarizability derivatives of a molecule with respect to its normal coordinate is given by $(45\alpha'^2 + 7\gamma'^2) = 2.80 \times 10^{-31} S$, where S is the Raman line intensity relative to the CCl_4 line at 458 cm^{-1}. The derivation is based on the anisotropy of benzene and the Raman intensities for C_6H_6 and C_6D_6 (Abstr. 6944/1955). D.H.Whiffen

535.345 : 536.48

9622. AN ATTEMPT TO DETECT INFRARED ABSORPTION IN LIQUID HELIUM. D.C.Baird, M.H.Edwards and G.Fleming.
Canad. J. Phys., Vol. 35, No. 7, 818-19 (July, 1957).

No absorption could be found in the region 1-4μ, the region 2.65-2.85μ being indeterminate because of absorption by the silica cell. G.F.Lothian

535.37

9623. THALLIUM-ACTIVATED SODIUM CHLORIDE RECRYSTALLIZATION PHOSPHORS. Z.Morlin.
Nature (London), Vol. 180, 89-90 (July 13, 1957).

Tl-activated NaCl disks were prepared from powder under a pressure of 1-20 × 10^3 kg/cm^2. Luminescent output on u.v. excitation decreased with time and varied with temperature; phosphorescence decay followed a hyperbolic law. A change from an exponential to a hyperbolic phosphorescence decay was observed when NaCl:Tl single crystals were deformed by stressing. J.Franks

535.37

9624. INVESTIGATION OF THE Eu^{+++} AFTERGLOW IN A THORIUM OXIDE PHOSPHOR. M.V.Fok (Fock).
Optika i Spectrosk., Vol. 2, No. 1, 127-35 (1957). In Russian.

A slotted disk with two slits at variable positions on the circumference is used to determine lifetimes of the afterglow for various lines (5900, 6102, 6170, 6204, 6342, 5871 A) emitted by the Eu-activated phosphor (ThO_2 or $ThO_2 \cdot Th(SO_4)$ with a few per cent $Na_2B_4O_7$ and Na_2HPO_4). The decay of intensity with time differs from one line to another but certain groups of lines give identical curves. The results are interpreted by a formula based on the assumption that the number of active recombinations (N) is related to the time (t) by a hyperbolic function $N = A/(a + t)^{\alpha}$, (A, a and α being arbitrary constants). L.Bovey

535.37 : 548.7

9625. LUMINESCENCE DECAY-TIME OF COLOUR CENTRES IN IONIC CRYSTALS.
A.M.Bonch-Bruevich, G.A.Tischenko and P.P.Feofilov.
Optika i Spektrosk., Vol. 2, No. 1, 136-40 (1957). In Russian.

Measurements of the decay-time (τ) over the temperature range −196 to +240°C were made on LiF, NaF and CaF_2 crystals which had been radiated by X- and γ-rays and the value was about 10^{-8} sec in all cases, with no change from +50°C to 196°C (τ decreased above 50°C in "red" CaF_2 centres). From τ and luminescence-yield coefficients the force constant f was found to be 0.01-0.03. L.Bovey

535.37 : 541.183

9626. THE INFLUENCE OF GAS ADSORPTION ON ZnO LUMINESCENCE. K.V.Tagantsev and A.N.Terenin.
Optika i Spektrosk., Vol. 2, No. 3, 355-60 (March, 1957). In Russian.

O_2 (dry or moist), O_3 and Xe were adsorbed on freshly sublimed ZnO surfaces, and the luminescence yields were determined by photoelectric methods. In all cases when the layer was in the gas for short periods the luminescence was decreased; when exposed to the exciting source the luminescence rapidly increased. The decrease is attributed to the formation of electron-trapping levels by the adsorbed electronegative molecules. The increased luminescence upon exposure to light is caused by photo-desorption of the adsorbed molecules. L.Bovey

535.37

9627. KINETICS OF γ-SCINTILLATIONS IN THALLIUM-ACTIVATED SODIUM IODIDE CRYSTALS. I.K.Plyavin'.
Optika i Spektrosk., Vol. 2, No. 3, 384-6 (1957). In Russian.

The form of single light pulses produced in NaI:Tl by γ-rays was investigated as a function of temperature in the range −150°C to +80°C. At room temperature the scintillations decayed exponentially with a time constant τ between 3.0×10^{-7} and 3.5×10^{-7} sec. τ increased as the temperature decreases. Below 0°C a second component of the scintillation decay appeared. Its time constant also increased as temperature fell. Below about −125°C a third component may be seen with $\tau \sim 10^{-7}$ sec. The activation energies for the first two components were found to be 0.15 eV and 0.05 eV respectively. S.Chomet

535.37

9628. PHOTOLUMINESCENCE OF THALLIUM BROMIDE. A.S.Vysochanskiĭ.
Optika i Spektrosk., Vol. 2, No. 3, 387-8 (1957). In Russian.

Experiments indicate that the luminescence of TlBr (which is stated to occur only below −160°C) is closely connected with the presence of a surplus of Tl in the TlBr lattice. The spectrum of the glow has two maxima (~ 5300 A and ~ 6400 A). TlBr appears to be a typical crystal phosphor in which the surplus Tl atoms play the role of an activator. S.Chomet

535.37

9629. ON EFFECTS OBSERVABLE IN INTERMITTENTLY IRRADIATED ALKALI HALIDE PHOSPHORS. I.A.Parfianovich.
Optika i Spektrosk., Vol. 2, No. 3, 392-5 (1957). In Russian.

KBr:Ni, KCl:Tl, and NaCl:Ni were irradiated with X-rays near the F-band. The intensity of emission by these substances during and after the irradiation was measured as a function of time under different conditions. An increase in the intensity of the phosphorescence excited by X-rays was found after the irradiation was stopped. This is connected with a redistribution of electrons and a transition of some of the electrons from F-levels to other less deep levels. S.Chomet

535.37

9630. THE RELATIONSHIP BETWEEN TEMPERATURE AND THE LUMINESCENT YIELD OF PLASTIC SCINTILLATORS WITH TRIPHENYLPYRAZOLINE. I.M.Rozman.
Optika i Spektrosk., Vol. 2, No. 4, 480-7 (1957). In Russian.

The yields of polystyrene scintillators, containing 0-2% 1,3,5-triphenylpyrazoline-Δ^2 (TPP) as an activator, obtained with radiation from α, β, γ and ultraviolet sources were examined at temperatures between 90° and 370°K. The yields decreased with increasing temperature. The results are interpreted in terms of migration of energy through the scintillator. L.Bovey

535.37

9631. LUMINESCENT SPECTRA OF PLASTIC [POLYSTYRENE] SCINTILLATORS WITH TRIPHENYLPYRAZOLINE.
E.A.Andreeshchev and I.M.Rozman.
Optika i Spektrosk., Vol. 2, No. 4, 488-93 (1957). In Russian.

A quantitative investigation of the luminescent yield was made by use of a monochromator and photomultiplier. Both ultraviolet (2537 A and 3650-3663 A) and β ($Ce-Pr^{144}$ source) radiation were used. Calculations showed that not less than 80% of the TPP luminescence was caused by radiationless transfer of the excitation energy, even for low activator concentrations (0.1% TPP by weight). See also preceding abstract. L.Bovey

535.371

9632. MECHANISM OF LUMINESCENCE IN THE ZnF_2:Mn PHOSPHOR. P.D.Johnson and F.H.Smith.
J. chem. Phys., Vol. 27, No. 2, 600-1 (Aug., 1957).

Decay rate measurements were made on ZnF_2, activated with 1-6 mole % MnF_2, excited with 1850 A and 5150 A radiation. The decay rate depends on activator concentration, the emission transition probability is the principle rate determining process for luminescence. An energy level diagram is constructed. J.Franks

535.371

9633. TRANSFER OF ENERGY IN SOLID PLASTIC SOLUTIONS. P.Avivi and A.Weinreb.
J. chem. Phys., Vol. 27, No. 3, 716-20 (Sept., 1957).

The mechanism of energy transfer from excited solvent molecules to the solute, in plastic phosphors is investigated. Energy transfer efficiencies in styrene and polystyrene solutions are compared. The question whether the phenomenon of energy transfer in plastic systems is the consequence of an intramolecular process in the polymer molecule, is discussed. It is shown that such a process is not an essential condition for high energy transfer efficiency in plastic solutions. The experimental data furnish strong evidence that energy transfer is the result of inter-molecular processes, similar to those occurring in liquid solutions. A.

535.371

9634. CHARACTERISTICS OF PLASTIC SCINTILLATORS. L.J.Basile.
J. chem. Phys., Vol. 27, No. 3, 801-6 (Sept., 1957).

Information on the light output of a group of organic solutes in polyvinyltoluene was obtained. The primary solutes studied were p-terphenyl and 2-phenyl-5-(4-biphenylyl)-1,3,4 oxadiazole (PBD), the latter being the most efficient. Of the secondary solutes studied, 4,4'-diphenylstilbene and 2,5-dibiphenylyl oxazole (BBO) are the most efficient. The best plastic scintillator developed contains a combination of 2-phenyl-5-(4-biphenylyl)-1,3,4 oxadiazole (PBD) and 4,4'-diphenylstilbene. The fluorescence spectra of these plastics scintillators were determined. When a secondary solute is added to a plastic scintillator the emitted light is mainly that of the secondary solute. The effect on the light output of the plastic scintillator upon addition of diphenylmercury was also investigated. Regardless of which combination of solutes was used, the mercury compound proved to be a serious quencher of light output. A.

535.371

9635. NATURE OF LUMINESCENT CENTERS IN ALKALI HALIDE AND ZINC SULFIDE PHOSPHORS. F.E.Williams.
J. Opt. Soc. Amer., Vol. 47, No. 10, 869-76 (Oct., 1957).

The present state of understanding of the luminescent centres in alkali halide and zinc sulphide phosphors is reviewed. These two classes of phosphors complement each other: the first is ionic; the second, primarily covalent. The energy levels of luminescent centres in alkali halides are approximated by states of the free impurity ion perturbed by crystalline interactions, whereas the levels of luminescent centres in zinc sulphide phosphors are suitably approximated by states of the crystal band structure perturbed by impurities. The theory of the excitation and emission spectra of thallium-activated potassium chloride is reviewed and extended to the problem of oscillator strengths for luminescent transitions. Semiconductor theory is applied to zinc sulphide phosphors, and the acceptor and donor nature of activator and coactivator, respectively, is thereby revealed. In contrast to semiconductors with small band gaps, association of acceptors and donors is shown to be important in transparent semiconductors. The energy-level structure and optical properties of various associated acceptor–donor pairs, as well as of isolated impurities, in zinc sulphide are discussed. A.

535.371

9636. THE INFRA-RED LUMINESCENCE OF IODINE. J.Franks.
Proc. Phys. Soc. B, Vol. 70, Pt 9, 892-5 (Sept., 1957).

The luminescence emission and excitation spectra of solid iodine were measured in the temperature range −70 to −180°C. The energy configurational coordinates for electronic states of iodine are deduced. J.Franks

535.372

9637. INFLUENCE OF ACTIVATOR ENVIRONMENT ON THE SPECTRAL EMISSION OF PHOSPHORS. G.R.Fonda.
J. Opt. Soc. Amer., Vol. 47, No. 10, 877-80 (Oct., 1957).

The spectral emission of phosphors varies widely with the composition of the basic compound, even under activation by the same element. In any series of isomorphous compounds, however, the variations can be coordinated. They are found to follow a definite rule that is based on corresponding variations in the field strength to which the activator ion is subjected by the anions of its environment. The field strength is shown to depend on the size of the crystal lattice and on the polarizability of the elements composing the crystal. A.

535.376

9638. FLUORESCENCE OF NAPHTHALENE AND ANTHRACENE VAPORS UNDER β-RAY EXCITATION. A.Shepp.
J. chem. Phys., Vol. 27, No. 3, 816-17 (Sept., 1957).

The fluorescence intensities of anthracene and naphthalene vapours, and a mixture of these, excited by the β-radiation from tritium gas, was measured by a photomultiplier, through filters. An analysis of the results shows them to be consistent with absorption by anthracene of the naphthalene 3500 A fluorescence. There is no evidence for photon emission from the third naphthalene band (2500 A). The tritium-activated fluorescence spectrum of anthracene vapour has been observed, extending from 3900 A to 4500 A. There is no evidence of emission from the second anthracene band at 3500 A. J.B.Birks

535.376

9639. TRAPPING ACTION IN ELECTROLUMINESCENT ZINC SULFIDE PHOSPHORS. C.H.Haake.
J. Opt. Soc. Amer., Vol. 47, No. 10, 881-7 (Oct., 1957).

The action of electron traps in electroluminescent ZnS phosphors is discussed on the basis of experimental results obtained from (a) the temperature and frequency dependence of the time-averaged electroluminescent brightness, (b) the temperature and frequency sensitivity of brightness waves, and (c) the initial rise of electroluminescent brightness. It is shown that much more importance must be ascribed to the existence of electron traps in electroluminescent phosphors than in ordinary photoluminescent phosphors. A.

535.376 : 537.311.33

9640. ANISOTROPY IN ELECTROLUMINESCENCE AND CONDUCTIVITY OF SINGLE CRYSTALS OF ZnS.
A.Lempicki, D.R.Frankl and V.A.Brophy.
Phys. Rev., Vol. 107, No. 5, 1238-9 (Sept. 1, 1957).

Synthetic ZnS single crystals possess highly anisotropic electrical properties. The dark conductivity may be as much as a factor of 10^6 larger in directions perpendicular to the c-axis than parallel to it. Photoconductivity and electroluminescent emission are also anisotropic but in smaller degree. It is proposed that these effects are caused by barriers due to stacking faults. A.

535.376

9641. ELECTROLUMINESCENCE OF DIAMOND. A.Fischer.
Z. Phys., Vol. 149, No. 1, 107-10 (1957). In German.

Insulating diamonds became luminescent and conducting in a field of 50 kV/cm independent of polarity, at higher fields (60 kV/cm) electrons were emitted. The threshold field under operation was about 10% below the initiating field strength. On passing currents exceeding 0.5 mA, the luminescence and conducting properties were irreversibly changed. After bombardment of a surface with boron ions, luminescence and conductivity were increased with the treated surface as anode, and reduced on reversing the polarity. J.Franks

535.391

9642. ACHROMATIC TRANSLUCENT FILMS.
T.N.Krylova and R.S.Sokolova.
Optika i Spektrosk., Vol. 2, No. 2, 254-62 (1957). In Russian.

With the help of a triple-film coating of TiO_2 and SiO_2 the reflection of light from a glass surface was decreased from 4-7 to 0.5% in the visible region. In a trial apparatus involving 22 optical components the amount of light passing when these had been coated increased 3-4 times. Experimental details of the film preparation and the optical characteristics of the layers are given. L.Bovey

535.41

9643. TWO-BEAM INTERFERENCE WITH PARTIALLY COHERENT LIGHT. B.J.Thompson and E.Wolf.
J. Opt.Soc. Amer., Vol. 47, No. 10, 895-902 (Oct., 1957).

A new proof of the general interference law for partially coherent fields is obtained and is illustrated by means of simple and direct experiments. Photographs are given which show the changes in the visibility of the fringes as the degree of coherence is varied and the results are compared with the predictions of the theory. A.

535.417

9644. THE USE OF A RECORDING FABRY–PEROT INTERFEROMETER WHOSE MIRRORS ARE IDENTICAL INTERFERENCE FILTERS. R.Dupeyrat.
C.R. Acad. Sci. (Paris), Vol. 245, No. 6, 656-9 (Aug. 5, 1957). In French.

It is pointed out that the usually accepted formula for defining fringe-width holds only for high reflectivity. The definition proposed by Miyake is adopted [ratio of order interval to fringe-width at half intensity $(I_m + I_M)/2$]. Curves are computed for this,and compared with experimental values for a group of two rays of which one is within the transparency band. S.Tolansky

535.417

9645. DESIGN OF A COMPACT WIDE APERTURE FIZEAU INTERFEROMETER. P.R.Yoder, Jr and W.W.Hollis.
J. Opt. Soc. Amer., Vol. 47, No. 9, 858-61 (Sept., 1957).

A theoretical investigation of the performance of the Fizeau type interferometer as a function of the collimating lens spherical aberration and the thickness of the air space between the interferometer plates is presented. The theory developed is applied to the determination of the maximum relative aperture permissible in a simple collimating lens system for use in an interferometer of specified plate separation. It is found that an f/3 lens system consisting of two plano-convex lenses can be used in an interferometer of 10 in. aperture with the plates separated as much as 0.050 in. In such a system, the instrumental error introduced into the fringe pattern is no greater than $\lambda/100$ for mercury green light. A.

535.421

9646. SHRINKAGE EFFECT IN GRATING RESOLUTION MEASUREMENT. D.H.Rank.
J. Opt. Soc. Amer., Vol. 47, No. 7, 671-2 (July, 1957).

The effect, under-estimation of resolving limit from measurement of close doublets, depends on the instrumental profile. Results of calculations are given, showing that for Schuster's slit function and a 3.2N slit the effect is only appreciable at separations below the Rayleigh limit. W.Weinstein

535.65

9647. CORRELATE FOR LIGHTNESS IN TERMS OF C.I.E.-TRISTIMULUS VALUES. II. G.Wyszecki and C.L.Sanders.
J. Opt. Soc. Amer., Vol. 47, No. 9, 840-2 (Sept., 1957).

A triangulation technique was used to check the definition of lightness as applied in Pt I (Abstr. 6080/1957). The results indicate that the procedure of defining lightness in terms of the luminous reflectance of neutral samples is satisfactory. The investigation has been further extended to show a systematic dependence of lightness index on background colour. As might be expected, the lightness index of colours similar to the background is decreased and the lightness index of complementary colours is increased relative to the lightness index obtained using a black background. This effect is due to the change in chromatic adaptation of the eye. A.

535.653

9648. SPACE ERROR IN COLOR MATCHING.
R.W.Burnham, J.R.Clark and S.M.Newhall.
J. Opt. Soc. Amer., Vol. 47, No. 10, 959-66 (Oct., 1957).

Recent reports indicate that stimulus position affects appearance in some visual situations. The present investigation was designed to yield information on the size of such a space error in colour matching, the precision of colour matching as a function of positional relations of the test and matching fields, and matching time as a function of position. Differences caused by position were not obtained. This is a reassuring result, since it has usually been assumed that no space error exists when symmetrical foveal areas are used for colour matching. A.

535.7

PHYSIOLOGICAL OPTICS. VISION. See under "Medical science. Human physiology". Decimal classification 612.84

535.81

9649. SELECTION OF OPTICAL GLASSES IN APOCHROMATS. N.v.d.W.Lessing.
J. Opt. Soc. Amer., Vol. 47, No. 10, 955-8 (Oct., 1957).

A method for the choice of glasses for an apochromatic system consisting of three lenses in contact with each other is developed. Applied graphically the method, although simple, is effective in selecting those glasses which give the smallest powers possible with a good distribution of power between the first and third lenses. It is also shown how the method can be applied analytically. A.

535.822.17 : 578.6

9650. THE ULTRA-ANOPTRAL MICROSCOPE, AN IMPROVEMENT OF WILSKA'S METHOD. V.Soran and B.Diaconeasa.
Naturwissenschaften, Vol. 44, No. 17, 465 (1957).

The negative phase-contrast method of Wilska is difficult to use with many vegetable tissues because of the strong diffractions in the cellulose walls of the cells. This difficulty has been overcome by combining dark-field illumination with negative phase-contrast. Some details of the microscope attachments are given and a specimen record is shown. R.W.Fish

HEAT 536

536.2.02 : 537.312.62

9651. ON THE MAGNITUDE OF THE CONTRIBUTION OF A CIRCULATION EFFECT TO THE THERMAL CONDUCTIVITY OF A SUPERCONDUCTOR. C.J.Gorter.
Canad. J. Phys., Vol. 34, No. 12A, 1334-5 (Dec., 1956).

"Electron transport" Conference paper (see Abstr. 8734/1957).

On the two-fluid model, the high heat transport in liquid He II is ascribed to convective counter-flow in the two fluids; it is usually thought that this effect will be of negligible importance in superconductors. The paper suggests a modified interpretation of the two-fluid model, which predicts that the effect may be appreciable in superconductors. R.G.Chambers

536.2.02 : 537.311.33

9652. HEAT TRANSFER IN SEMICONDUCTORS. A.F.Joffé.
Canad. J. Phys., Vol. 34, No. 12A, 1342-55 (Dec., 1956).

"Electron transport" Conference paper (see Abstr. 8734/1957).

Measured values of thermal conductivity as a function of temperature, in the range -100°C to 500°C, are presented for several materials (KCl, KBr, PbTe, Ge, Bi_2Te_3 and the alloys PbTe–PbSe, Si–Sn, Ge–Si). Attempts are made to interpret the results in terms of the transport of heat by electrons, holes (including ambipolar diffusion), phonons and excitons. R.Stratton

536.212 : 537.311.31

9653. ELECTRICAL AND THERMAL CONDUCTIVITY OF METALS. K.Mendelssohn.
Canad. J. Phys., Vol. 34, No. 12A, 1315-27 (Dec., 1956).

"Electron transport" Conference paper (see Abstr. 8734/1957).

A review of recent work at Oxford; in particular, work on the thermal conductivity of various Pb alloys in the normal and superconducting states, which shows the strong effect of impurities on the electronic contribution (in the normal state) and the very small effect on the phonon contribution (in the superconducting state). R.G.Chambers

536.212 : 537.311.31

9654. CONDUCTIVITY OF METALS AT LOW TEMPERATURES. G.K.White.
Canad. J. Phys., Vol. 34, No. 12A, 1328-33 (Dec., 1956).

"Electron transport" Conference paper (see Abstr. 8734/1957).

A brief review of recent measurements on the low-temperature electrical and thermal conductivities of group I metals and transition metals, and the thermal conductivity of solid argon. R.G.Chambers

536.212.2 : 537.311.31 : 536.48

9655. LOW TEMPERATURE RESISTIVITY OF TRANSITION ELEMENTS: VANADIUM, NIOBIUM, AND HAFNIUM.
G.K.White and S.B.Woods.
Canad. J. Phys., Vol. 35, No. 8, 892-900 (Aug., 1957).

Measurements of the thermal conductivity from 2° to 90°K. and electrical conductivity from 2° to 300°K are reported for vanadium, niobium, and hafnium. Although the vanadium and hafnium are not as pure as might be wished, measurements on these metals and on niobium allow a tabulation of the "ideal" electrical resistivity due to thermal scattering for these elements from 300°K down to about 20°K. Ice-point values of the "ideal" electrical resistivity are 18.3 $\mu\Omega$ cm for vanadium, 13.5 $\mu\Omega$ cm for niobium, and 29.4 $\mu\Omega$ cm for hafnium. Values for the "ideal" thermal resistivity of vanadium and niobium are deduced from the experimental results although for vanadium and more particularly for hafnium, higher purity specimens are required before a very reliable study of "ideal" thermal resistivity can be made. For the highly ductile pure niobium, the superconducting transition temperature, as determined from electrical resistance, appears to be close to 9.2°K. A.

536.22/.23 : 533.16 : 532.13

VISCOSITY AND THERMAL CONDUCTIVITY OF LIQUIDS AND GASES. See Abstr. 9557

536.22/.23 : 539.62

ON THE CONNECTION BETWEEN SURFACE FRICTION AND HEAT EXCHANGE. See Abstr. 9437

536.23.08

9656. THERMAL CONDUCTIVITY OF NITROGEN BETWEEN 75° AND 700°C AND UP TO 1000 TO 1600 ATM. P.Johannin.
C.R. Acad. Sci. (Paris), Vol. 244, No. 22, 2700-3 (May 27, 1957).
In French.

The apparatus, consisting of two coaxial silver cylinders separated by a gap, 0.2 mm wide, is briefly described. The difference in temperature, ΔT, between the cylinders is measured by four Pt/Pt–10% Rh thermocouples arranged differentially and in series. The central portion of the external cylinder is electrically heated by a platinum winding, and the wattage kept constant and measured to 5×10^{-4} watt. The conductivity cell is surrounded by a furnace which is insulated from the surrounding enclosure and this is cooled externally by a flow of water. The furnace temperature is controlled and is stable to 0.01°C at 400°C and 0.05°C at 700°C. The geometrical constant K in the formula $\lambda = K(W/\Delta T)$ relating the thermal conductivity λ to the energy transmitted across the gap W, was obtained by measuring the electrical capacitance of the cell and assuming similarity between the electrical and thermal fields. The results for λ are shown graphically; for temperatures up to 300°C as a function of the density in amagat units and compared with values of other workers, and for temperatures up to 700°C as a function of the pressure in atmospheres. S.Weintroub

536.424 : 536.44

9657. PHASE TRANSITIONS AND CRITICAL PHENOMENA IN ANISOTROPIC PHASES. V.K.Semenchenko.
Kristallografiya, Vol. 2, No. 1, 145-52 (1957). In Russian.

A thermodynamical discussion, illustrated by consideration of thermal expansion, heat capacity and light scattering of quartz on raising the temperature through the point of $\alpha-\beta$ transition.
R.F.S.Hearmon

536.45 : 537.562

TEMPERATURES IN THE RANGE 10^5-10^6 K°. See Abstr. 9741

536.48 : 535.345

AN ATTEMPT TO DETECT INFRARED ABSORPTION IN LIQUID HELIUM. See Abstr. 9622

536.48

9658. NONISOTHERMAL FLOW OF HELIUM II FILM.
K.L.Chopra and J.B.Brown.
Phys. Rev., Vol. 107, No. 4, 915-16 (Aug. 15, 1957).

The flow of helium II film is studied under conditions in which the temperature of the midpoint of the film can be changed in two ways. It is found that when cooling is effected by direct pumping on the film, flow is stopped with a cooling of about one millidegree. When cooling is by contact with a cold reservoir, however, there is no effect on the flow rate up to 40 millidegrees change. The film can thus flow through a temperature well. Further support is also given to the view that film transport rates are the same whether induced by gravitational or thermomechanical potential differences. A.

536.48

9659. DENSITY AND VISCOSITY OF NORMAL FLUID IN DILUTE SOLUTIONS OF He^3 IN He^4. J.G.Dash and R.D.Taylor.
Phys. Rev., Vol. 107, No. 5, 1228-37 (Sept. 1, 1957).

The torsion pendulum technique was applied to the study of normal fluid density and viscosity of dilute solutions of He^3 in He^4 from 1.3°K to the lambda points. Three isotopic mixtures and pure He^4 yielded data which cover the range from 0 to 11 mole-per-cent He^3 concentration. Lambda temperatures are found to vary as the two-thirds power of the He^4 mole fraction. Densities at T_λ indicate a liquid volume contraction proportional to the concentration of He^3. Normal fluid densities at lower temperatures are described by a single analytic function for all solutions and temperatures studied. The experimental values may be interpreted in terms of an effective hydrodynamic density of He^3; empirical behaviour of the effective He^3 density is seen to increase linearly with the density of superfluid, in qualitative agreement with the model suggested by Feynman. Viscosities of all solutions exhibit temperature variations similar to that of pure He^4. Dependence of the viscosity on He^3 concentration appears to be markedly nonlinear at all temperatures. Analysis of the data in terms of the Landau–Khalatnikov theory of viscosity, together with additional simple assumptions, yields an empirical estimate of the roton–He^3 atom collision cross-section. A.

536.5.081

9660. THE FREEZING POINTS OF HIGH PURITY METALS AS PRECISION TEMPERATURE STANDARDS. II. AN INVESTIGATION OF THE FREEZING TEMPERATURES OF ZINC, CADMIUM, AND TIN. E.H.McLaren.
Canad. J. Phys., Vol. 35, No. 9, 1086-106 (Sept., 1957).

For Pt I, see Abstr. 3210 (1957). Using appropriate techniques, plateaus of essentially constant ($< \pm$ 0.0001 deg C) temperature with durations of over 1 hr were readily obtained on the cooling curves of these metals. For series of freezes on particular samples, the standard deviations of the respective plateau temperatures were found to be of the order of $\pm$0.0002 deg C. It was not possible to distinguish among the plateau temperatures of three samples selected from different distillation batches of New Jersey S.P. zinc. Evidence is presented on the long term stability ($2\frac{1}{2}$ years) of the plateau freezing temperature of S.P. zinc determined with six standard thermometers. The pressure effects on the freezing temperatures were found to be 0.0043 deg C, 0.0062 deg C, and 0.0033 deg. C per atmosphere for zinc, cadmium, and tin respectively. Thermal analysis of these high purity metals reveals alloy structures and other features associated with nucleation, coring, and annealing phenomena; typical thermal curves are shown. A.

536.531 : 536.48

9661. INDIUM RESISTANCE THERMOMETER; 4 TO 300°K.
G.K.White and S.B.Woods.
Rev. sci. Instrum., Vol. 28, No. 8, 638-41 (Aug., 1957).

The possible advantages are discussed of a resistance thermometer made with a metallic element of low Debye characteristic temperature and very high purity, e.g., ratio of residual resistance to ice-point resistance of 10^{-4}. Measurements on the electrical resistance of commercially available indium wire from 3 to 300°K suggest that it may be a useful thermometer as it remains temperature sensitive down to its superconducting transition at 3.41°K, because of its high purity and $\theta \sim 100$°K. A.

536.581.2 : 621.316.72

9662. A PRECISION BATH THERMOSTAT.
W.Wilson and N.W.B.Stone.
J. sci. Instrum., Vol. 34, No. 8, 327-9 (Aug., 1957).

A thermostat is described for controlling the temperature of a 30 l. paraffin bath slightly above room temperature to a thousandth of a degree Celsius. An a.c. bridge is used in connection with a phase-sensitive valve (originally developed as a frequency modulation detector). A.

536.628.2

9663. AUTOMATIC TEMPERATURE CONTROL FOR AN ADIABATIC CALORIMETER. W.W.Cleland and R.S.Harding.
Rev. sci. Instrum., Vol. 28, No. 9, 696-8 (Sept., 1957).

A control device for an oxygen bomb calorimeter has been developed which keeps the temperature of the outer water jacket equal to that of the inner bath. When the temperature of the inner bath is not changing rapidly, heat losses are negligible; however, the error due to lag when the inner bath temperature is rising rapidly is about two parts per thousand. This degree of precision permits the accurate analysis of samples of low caloric content such as lyophilized urine. Since the technician need not watch the calorimeter

once the bomb has been fired, but instead can prepare a second bomb, the number of samples analysed in a given time can be doubled if two bombs are available for use with the calorimeter. A.

536.631 : 538.22 : 539.219

9664. PROPERTIES OF PALLADIUM–RHODIUM ALLOYS.
F.E.Hoare and J.Preston.
Nature (London), Vol. 180, 334 (Aug. 17, 1957).

Earlier results have been confirmed, showing that the magnetic susceptibility goes through a sharp maximum at 5% Rh concentration. The electronic specific heat term has now been measured below 4°K; this also shows a maximum at 5% Rh, but very much less pronounced. It is difficult to account for this difference on the usual model. R.G.Chambers

536.631

9665. ON THE ATOMIC AND ELECTRONIC SPECIFIC HEATS OF THORIUM. K.Clusius and P.Franzosini.
Z. Naturforsch., Vol. 11a, No. 11, 957 (Nov., 1956). In German.

Measurements of Smith and Wolcott below 4°K give for the electronic term $\gamma = 11.2 \times 10^{-4}$ cal/g-atom deg^2. Earlier measurements between 20 and 300°K, however, yield a reasonably constant Debye θ if one assumes $\gamma \cong 19 \times 10^{-4}$. This discrepancy may be due to the effect of impurities enhancing the lattice specific heat. R.G.Chambers

536.662

9666. HEATS OF COMBUSTION OF SOME PEROXIDES AND THE HEATS OF FORMATION OF ACETATE, PROPIONATE, AND BUTYRATE RADICALS. L.Jaffe, E.J.Prosen and M.Szwarc.
J. chem. Phys., Vol. 27, No. 2, 416-20 (Aug., 1957).

Heats of combustion of acetyl, propionyl, and butyryl peroxide were measured using a bomb calorimeter. The heats of formation obtained are: $\Delta Hf = -127.9$ for acetyl peroxide, -148.2 for propionyl peroxide, and -161.0 for butyryl peroxide (in kcal/mole for the liquid state at 25°C). The heats of formation of the acetate, propionate, and butyrate radicals are computed and the relative stability of the acetate compared to the benzoate radical is discussed. The RC(O)O–H bond dissociation energies in the respective acids and the sums of electron affinities plus solvation energies of the respective ions are computed. These calculations seem to indicate that acidic properties of carboxylic acids are due to the high electron affinities + solvation energies of R·COO radicals, and not to the low R·CO·O–H bond dissociation energies, since the latter are comparatively high. A.

THERMODYNAMICS 536.7/.8

536.7

9667. ON IRREVERSIBLE TRANSFORMATIONS IN THE NEIGHBOURHOOD OF A STATIONARY STATE CONSTRAINED BY CONSTANT CURRENTS. P.Glansdorff and J.Passelecq.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 43, No. 3, 188-94 (1957). In French.

As an extension of previous work by Glansdorff and Prigogine (Abstr. 1790/1955) it is shown that variations in forces (X_i) and currents (J_i) in the neighbourhood of a stationary state constrained by fixed currents at the boundaries satisfy $\Sigma_i \delta X_i \delta J_i \geq 0$. This result is independent of the Onsager symmetry conditions and is therefore valid away from equilibrium. R.O.Davies

536.71

9668. MONTE CARLO EQUATION OF STATE OF MOLECULES INTERACTING WITH THE LENNARD-JONES POTENTIAL. I. A SUPERCRITICAL ISOTHERM AT ABOUT TWICE THE CRITICAL TEMPERATURE. W.W.Wood and F.R.Parker.
J. chem. Phys., Vol. 27, No. 3, 720-33 (Sept., 1957).

Values obtained by Monte Carlo calculations are reported for the compressibility factor, excess internal energy, excess constant-volume heat capacity, and the radial distribution function of Lennard-Jones (12,6) molecules at the reduced temperature $kT/\epsilon^* = 2.74$, and at thirteen volumes between $v/v^* = 0.75$ and 7.5. (v is the molar volume; $v^* = 2^{-1/2}N_0{r^*}^3$; N_0 is Avogadro's number; ϵ^* is the depth, and r^* the radius of the Lennard-Jones potential well.) The results are compared with the experimental observations of Michels (~ 150-2000 atm) and Bridgman (~ 2000-15 000 atm) on argon at 55°C, using Michels' second virial coefficient values for the potential parameters. Close agreement with Michels is found, but significant disagreement with Bridgman. The Monte Carlo calculations display the fluid–solid transition; the transition pressure and the volume and enthalpy increments are not precisely determined. The Lennard-Jones–Devonshire cell theory gives results which disagree throughout the fluid phase, but agree on the solid branch of the isotherm. Limited comparisons with the Kirkwood–Born–Green results indicate that the superposition approximation yields useful results at least up to $v/v^* = 2.5$. A.

ELECTRICITY 537

537.122

9669. THE MODEL OF THE ELECTRON.
M.Skorko and E.Skorko.
Nuovo Cimento, Vol. 6, No. 2, 364-6 (Aug., 1957).

A discussion of the properties of a model in which the electron consists of a magnetic disk rolling without sliding, with mass uniformly distributed and a point charge on the periphery of the disk. L.Pincherle

537.122

9670. MAGNETIC DIPOLE MOMENT OF THE ELECTRON.
C.M.Sommerfield.
Phys. Rev., Vol. 107, No. 1, 328-9 (July 1, 1957).

The fourth-order radiative corrections to the magnetic dipole moment of the electron, previously calculated by Karplus and Kroll (1949), have been worked out again using the mass-operator formalism of Schwinger. The result was $\mu_e^{(4)}/\mu_0 = 0.328\,\alpha^2/\pi^2$, giving $\mu_e/\mu_0 = 1.001\,159\,6$, to be compared with the previous value 1.001 145 4. The discrepancy has been traced to the term $\mu^{\mathrm{I}} + \mu^{\mathrm{IIc}}$ of Karplus and Kroll. Petermann (to be published) finds that μ^{IIc} of Karplus and Kroll does not lie within appropriate bounds. However a complete comparison of the two answers is difficult because the grouping of the terms is very different. The effect that the new value has on the theoretical values of the fine-structure constant and of the Lamb shift is discussed. L.Pincherle

ELECTROSTATICS. DIELECTRICS 537.2

537.212

9671. INTERACTION ENERGY OF ELECTRIC CHARGES IN A VERY THIN TUBE. S.Olszewski.
Nature (London), Vol. 179, 1296 (June 22, 1957).

A method is outlined, which now gives finite values for the energies in two problems in classical electrostatics: the interaction energy of two charges in a one-dimensional linear space and the self-energy of a one-dimensional continuous distribution of charge. The interaction energy of charges in a cylinder of finite cross-section is calculated and then the limit is derived when the cylinder radius tends to zero. The interaction potential is represented by a Green function for the three-dimensional Laplace–Poisson equation. A.E.Kay

537.226.1 : 539.133

9672. ELECTRIC QUADRUPOLE MOMENTS AND DIELECTRIC CONSTANTS. A.D.Buckingham and J.A.Pople; R.W.Zwanzig.
J. chem. Phys., Vol. 27, No. 3, 820-1, 821 (Sept., 1957).

See Abstr. 7371 (1956).

537.226.1

9673. POWER LOSS BY POLAR MOLECULES IN AN A.C. FIELD. H.P.Bhattacharyya.
Nature (London), Vol. 179, 831 (April 20, 1957).

It is argued that the Debye relaxation effect corresponds to a critically damped vibration and the Fröhlich resonance absorption to an under-damped vibration. Therefore a third, over-damped, case should exist, which would be characterized by two time constants, one being very large. It is suggested that the behaviour of "electrets" may be an example of over-damping. K.W.Plessner

537.226.2

9674. DIELECTRIC PROPERTIES OF SOME LIQUID ALKYL HALIDES. D.J.Denney.
J. chem. Phys., Vol. 27, No. 1, 259-64 (July, 1957).

Dielectric dispersion and loss in the liquid alkyl halides at low temperatures can be represented by a skewed-arc locus in the complex plane similar to that found for polyhydroxy compounds. Small deviations at very high frequencies, $f \gg f_0$, account for 5% or less of the dipolar dispersion. As with the alcohols and glycols the Arrhenius rate plot exhibits strong curvature. These departures

from Debye first-order rate theory and the concept of a temperature-independent "molecular" activation energy are discussed in relation to structural effects which may be the dominating factor in the dielectric behaviour of liquids at low temperatures. The need for a detailed analysis of the dynamics of the relaxation process is stressed. A.

537.226.2 : 541.64

9675. LOW-TEMPERATURE DIELECTRIC ABSORPTION IN POLYMETHYL METHACRYLATE. D.J.Scheiber and D.J.Mead.
J. chem. Phys., Vol. 27, No. 1, 326-7 (July, 1957).

Unconditioned specimens, and others immersed in water for 24 hours, showed dielectric absorption at -20°C. None was observed if the specimens were dessicated. Thus the γ-transition suggested by Deutsch et al. (Journal of Polymer Science, Vol. 13, 565, 1954) may be due to absorbed moisture. J.H.Mason

537.226.2 : 621.315.612

9676. THE INFLUENCE OF THE METAL OF ELECTRODES ON AGEING OF CERAMIC DIELECTRICS.
I.E.Balygin and K.S.Porovskiĭ.
Zh. tekh. Fiz., Vol. 27, No. 3, 513-15 (1957). In Russian.

Prolonged d.c. tests carried out at increased temperature on two kinds of ceramic material with electrodes made of various metals (Pt, Ag, Al) showed that the rate of insulation deterioration was most rapid for samples with silver anodes. These specimens broke down after periods of up to a few hundred hours. The nature of the cathode seemed to have no effect on ageing. Formation of coloured layers due to electrolytic migration of ions from oxides present in the ceramics was also observed. It is concluded that both diffusion of the electrode metal into the ceramic and electrolytic migration of ions are chief reasons for insulation ageing.
E.M.Dembinski

537.226.2

9677. ON THE FERROELECTRIC DOMAIN STRUCTURE OF ROCHELLE SALT. E.Straubel-Fischer.
Naturwissenschaften, Vol. 44, No. 7, 230-1 (1957). In German.

The domain structure on (011) planes has been made visible by etching with water. It has been found that the domains do not always lie parallel to the x-axis, but deviate up to 15° from this direction. K.W.Plessner

537.226.2 : 537.228.1

9678. THE DIELECTRIC AND PIEZOELECTRIC PROPERTIES OF POLARIZED $BaTiO_3$ CERAMICS IN VARIOUS FERROELECTRIC PHASES. L.A.Shuvalov.
Kristallografiya, Vol. 2, No. 1, 119-29 (1957). In Russian.

Equations are given connecting the piezoelectric and dielectric constants of single-crystal $BaTiO_3$ with those of the polarized polycrystalline material. The effect of change in the polarizing field and in the distribution of domain angles on the constants is discussed, as is also the change in distribution of angles with phase transition. R.F.S.Hearmon

537.226.2 : 537.228.2

9679. DECAY EFFECTS IN BARIUM TITANATE CERAMICS. H.L.Allsopp.
Phil. Mag. (Eighth Ser.), Vol. 2, 1100-2 (Sept., 1957).

The manner in which the polarization–field and polarization–strain curves change with time, after the application of a high alternating field, has been investigated for ceramic specimens, and twinned single crystals of barium titanate. It is suggested that 90° domain rotations produce the observed initial enhancement of the polarization, and that the internal stresses caused by these changes in the ceramic specimens are responsible for the decay effects on removing the field. The shapes of the polarization–strain curves, and the absence of decay effects in twinned single crystals are in agreement with this explanation. L.E.Cross

537.228.1

9680. THE SHEAR PIEZOELECTRIC MODULUS OF POLARIZED BARIUM TITANATE. S.V.Bogdanov, B.M.Vul and R.Ya.Razbash.
Kristallografiya, Vol. 2, No. 1, 115-18 (1957). In Russian.

The moduli d_{24} and d_{33}, as determined by static methods, are found to have the values 5.5×10^{-6} and 4.0×10^{-6} c.g.s. e.s.u. for polarized polycrystalline barium titanate. Using the value for d_{33} in conjunction with earlier estimates of d_{15} and d_{31} the moduli of single-crystal barium titanate are estimated as $d_{33} \cong 8.0$, $d_{31} \cong -3.0$, $d_{15} \cong 11.0$, all $\times 10^{-6}$ c.g.s. e.s.u. The values for d_{33} and d_{31} agree well with the estimates of Bond et al. (Abstr. 6956/1951). R.F.S.Hearmon

537.228.1 : 548.2

9681. WOOD AS A PIEZOELECTRIC TEXTURE. V.A.Bazhenov.
Kristallografiya, Vol. 2, No. 1, 108-14 (1957). In Russian.

A theoretical discussion of the influence of the structure and cellulose orientation on the piezoelectric properties of wood.
R.F.S.Hearmon

ELECTRIC CONDUCTION. CURRENTS 537.3

537.311.31 : 538.632

9682. HALL EFFECT IN TITANIUM, VANADIUM, CHROMIUM, AND MANGANESE. S.Foner.
Phys. Rev., Vol. 107, No. 6, 1513-16 (Sept. 15, 1957).

The Hall effect in Ti, V, Cr, and Mn was measured at room temperature with fields up to 30 kilo-oersteds. The Hall constant was positive for all of these elements. The effect is extremely small in Ti and apparently sensitive to small amounts of impurities. The results for these transition elements indicate that electrical conduction is predominantly due to hole conduction. A.

537.311.31 : 536.48 : 536.212.2

LOW TEMPERATURE RESISTIVITY OF TRANSITION ELEMENTS: VANADIUM, NIOBIUM, AND HAFNIUM. See Abstr. 9655

537.311.32/.33

9683. ELECTRICAL PROPERTIES OF $BaTiO_3$ CONTAINING SAMARIUM. G.G.Harman.
Phys. Rev., Vol. 106, No. 6, 1358-9 (June 15, 1957).

The variation of electrical conductivity with temperature has been measured for $BaTiO_3$ ceramics containing from 0.025 to 0.20 mol. % Sm_2O_3. The resistivity changes correlate with the ferroelectric structure changes. Above 120°C the resistivity rises rapidly with temperature, between 120°C and 0°C the resistivity is approximately constant, and below 0°C the resistivity increases with decreasing temperature in the manner characteristic of a semiconductor with small thermal activation energy. It is suggested that the concentration of samarium in the ceramic is sufficient to produce impurity-band conduction, and that the symmetry changes in the $BaTiO_3$ modify the band structure and thus change the conductivity. L.E.Cross

537.311.32/.33 : 538.632

9684. ON THE HALL EFFECT IN BISMUTH AT PRESSURES UP TO 30 000 kg/cm². A.I.Likhter and L.F.Vereshchagin.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 618 (1957). In Russian.

Hall effect and resistivity were measured as a function of pressure and magnetic field. The transitions I–II and II–III were indicated by jumps in resistivity. The Hall constant decreased with increasing pressure, reaching a limiting value (in modification III) of three orders less than the N.T.P. value. The evidence suggests that Bi-III is a real metal, ordinary Bi being a semi-metal.
J.B.Arthur

537.311.33

9685. THE MASS ACTION LAWS FOR THE REACTIONS BETWEEN FREE CARRIERS AND IMPURITIES IN SEMICONDUCTORS CONSIDERING ELECTRON SPIN. F.W.G.Rose.
Proc. Phys. Soc. B, Vol. 70, Pt 8, 801-3 (Aug., 1957).

The mass action law is applied to obtain the "reaction constants" appropriate to "reactions" between impurities and free carriers. The formulation includes the factors $\frac{1}{2}$ or 2 which arise from the electron spin. P.T.Landsberg

537.311.33

9686. ON THE ABSORPTION BY FREE CARRIERS IN SEMICONDUCTORS. B.Donovan and N.H.March.
Proc. Phys. Soc. B, Vol. 70, Pt 9, 883-5 (Sept., 1957).

An approximate treatment of the effect of lattice vibrations on absorption in alternating fields given by the authors previously (Abstr. 6632/1956) is shown to fit the experimental data of Fan, Spitzer and Collins (Abstr. 2101/1956) on the infrared absorption of n-type, Ge, better than the more refined theory used by Fan et al.
D.Haneman

537.311.33

9687. THE RELATIONSHIP BETWEEN THE HALL COEFFICIENT AND THE RESISTIVITY OF SEMICONDUCTORS, TAKING VARIOUS SCATTERING MECHANISMS OF THE CHARGE CARRIERS INTO ACCOUNT. T.Fukuroi and C.Yamanouchi.
Sci. Rep. Res. Insts Tôhoku Univ. A, Vol. 9, No. 4, 267-72 (Aug., 1957).

Jones (Abstr. 3527/1951) has given an expression for the Hall coefficient of semiconductors taking into account both the thermal and the ionized impurity scattering of electrons (or holes) in a band. As temperature decreases the influence caused by the neutral impurity scattering and the dislocation scattering becomes appreciable. Taking into consideration every two scattering mechanisms out of four mechanisms mentioned above, the relations between the Hall coefficient and the resistivity are calculated in a way analogous to that of Jones. A.

537.311.33

9688. ON THE TEMPERATURE DEPENDENCE OF THE MOBILITY IN NON-POLAR SEMICONDUCTORS. D.Dorn.
Z. Naturforsch., Vol. 12a, No. 1, 18-22 (Jan., 1957). In German.

In the usual Bloch theory, the assumption of elastic electron collisions with acoustic lattice vibrations leads to the $T^{-3/2}$ law (T = absolute temperature). However, if the energy change of the electrons during collisions is considered, a correction factor of the form $(1 + A\theta/T)$ is found, where θ is a characteristic temperature of order 1°K and A is a numerical constant. Straightforward evaluation of the perturbed distribution function to a higher order gives A = 23/9 while a variational procedure, which avoids uncertain conclusions about low energy electrons ($E \sim< k\theta$), leads to A = 2153/765 for the third approximation. R.Stratton

537.311.33

9689. FIELD DEPENDENCE OF MOBILITY IN P-TYPE GERMANIUM. K.S.Mendelson and R.Bray.
Proc. Phys. Soc. B, Vol. 70, Pt 9, 899-900 (Sept., 1957).

Measurements on a series of samples, with carrier densities varying from 3×10^{12} to 4×10^{15} cm^{-3}, at 78°K, showed that their mobility was proportional to $E^{-0.6}$ for electric fields E in the range 600 to 10^4 V/cm. At 195°K a decrease in mobility was also observed but the $E^{-0.6}$ dependence was not reached for the highest field applied (5×10^3 V/cm). R.Stratton

537.311.33 : 538.63

9690. THE MAGNETORESISTANCE OF InAs. H.Weiss.
Z. Naturforsch., Vol. 12a, No. 1, 80 (Jan., 1957). In German.

Measurements on a single crystal at fields up to 10 000 Oe yield the law $\Delta\rho/\rho$ = const. $B^{1.65}$ where B is the magnetic induction. C.A.Hogarth

537.311.33 : 537.312.8

9691. GALVANOMAGNETIC EFFECTS IN N-TYPE InSb AT 4.2°K. H.P.R.Frederikse and W.R.Hosler.
Canad. J. Phys., Vol. 34, No. 12A, 1377-8 (Dec., 1956).

"Electron transport" Conference paper (see Abstr. 8734/1957). Both the transverse and longitudinal magnetoresistance were found to be negative for fields below a few hundred gauss but positive for higher fields. An oscillatory variation in the curve of longitudinal magnetoresistance against magnetic field at about 3400 gauss is ascribed to the quantization of the electron orbits. R.Stratton

537.311.33

9692. DISCUSSION OF THE ELECTRICAL PROPERTIES OF COMPOUNDS WITH THE NICKEL ARSENIDE STRUCTURE. W.B.Pearson.
Canad. J. Phys., Vol. 35, No. 8, 886-91 (Aug., 1957).

A valence scheme is proposed for alloys such as CrSe, MnTe, and FeSe, with the nickel arsenide structure, which indicates why they may be semiconductors, while chalcogenides of Co and Ni and antimonides and bismuthides of Cr, Mn, Fe, Co, and Ni with a similar structure are metallic. The valence scheme is thus consistent with the known electrical properties (and also magnetic properties) of these phases. It then predicts that FeSe and CrS may well be semiconductors and indicates that all other compounds of Cr, Mn, Fe, Co, and Ni with the NiAs structure should be metallic. A.

537.311.33

9693. THE EFFECT OF OXYGEN ON AN EVAPORATED PbSe LAYER. R.H.Jones.
Proc. Phys. Soc. B, Vol. 70, Pt 7, 704-8 (July, 1957).

Layers, 0.1-1.0 μ thick, of PbSe were vacuum evaporated on to substrates at 90°K and then heated in vacuo to 350°C, the original p-type conduction changing to n-type. The layers were then alternately exposed to oxygen (1.6×10^{-2} mm Hg pressure) and treated in vacuo at 350°C, a continuous record of conductivity being made. From measurements it is concluded that oxygen provides electron acceptor levels, oxygen filling selenium vacancies during oxidation periods until minimum conductance is reached. Conductivity–temperature relations give an activation energy of 0.34 → 0.44 eV agreeing with the energy gap of 0.37 eV in PbSe obtained from other data on single crystals. G.F.J.Garlick

537.311.33 : 534.23

ULTRASONIC ATTENUATION BY FREE CARRIERS IN GERMANIUM. See Abstr. 9578

537.311.33 : 539.27

9694. DEPICTING p–n JUNCTIONS IN SEMICONDUCTORS BY MEANS OF REFLECTION ELECTRON MICROSCOPY. G.Bartz and G.Weissenberg.
Naturwissenschaften, Vol. 44, No. 7, 229 (1957). In German.

Images obtained either by the reflection of relatively high-energy electrons, or by secondary emission using 50 eV primary electrons, show the p–n junction on a single crystal of silicon very clearly. The effect of applying bias voltages to the junction is demonstrated in a series of photographs. K.W.Plessner

537.311.33

9695. LOW–HIGH CONDUCTIVITY JUNCTIONS IN SEMICONDUCTORS. L.W.Davies.
Proc. Phys. Soc. B, Vol. 70, Pt 9, 885-9 (Sept., 1957).

Calculations for low-level currents in these are given taking into account diffusion of charge carriers in the vicinity of the junction and neglecting the depletion layer. D.Haneman

537.312.5

9696. PHOTOCONDUCTIVITY OF ANTHRACENE. III. D.M.J.Compton, W.G.Schneider and T.C.Waddington.
J. chem. Phys., Vol. 27, No. 1, 160-72 (July, 1957).

The photoconductivity of anthracene was studied using three types of crystals, large scintillation crystals, crystals grown from dimethylformamide, and sublimation flakes. The existence of a true bulk conductivity, as well as a surface conductivity was demonstrated. This bulk conductivity is not affected by oxygen. The space charge found by previous workers is shown to be located at the electrodes and to be due to poor contacts. The dependence of both the surface and the bulk photocurrent on temperature, voltage, and wavelength and intensity of light, were studied and found to be markely different from each other. The surface photocurrent shows a non-ohmic voltage dependence. It is concluded that the formation of charge carriers is not a primary process of light absorption, but a secondary process, competing with fluorescence and thermal degradation of the absorbed light energy, which is free to move through the crystal in the form of excitons. A mechanism for the migration of charge carriers has been put forward to explain the main features of the photoconduction. A much higher effective carrier mobility on the surface than in the bulk of the crystal is postulated. The behaviour of the surface photocurrent is interpreted in terms of the formation of carriers in the bulk, those that diffuse to the surface playing the greater part in carrying the current. The bulk current is considered as a recombination-limited photocurrent. In agreement with previous workers, it is concluded that most of the current is carried by positive holes. A.

537.312.5

9697. PHOTOCONDUCTION OF PHTHALOCYANINES IN PRESENCE OF OXYGEN. J.A.Bornmann.
J. chem. Phys., Vol. 27, No. 2, 604-5 (Aug., 1957).

The dark currents and photocurrents in copper, cobalt and lead phthalocyanines are increased in the presence of oxygen, but remain unchanged in metal-free phthalocyanine. J.Franks

537.312.62

9698. SUPERCONDUCTIVITY OF URANIUM. R.A.Hein, W.E.Henry and N.M.Wolcott.
Phys. Rev., Vol. 107, No. 6, 1517-20 (Sept. 15, 1957).

A ballistic mutual-inductance technique was employed to investigate the magnetic susceptibility of two uranium samples down to a temperature of 0.1°K. Both samples exhibited a superconducting transition in zero magnetic field at a temperature (T_C) of 0.68 ± ± 0.02°K. The transitions were not sharp, being spread over a temperature interval of 0.45 deg K. The critical magnetic field of one of the samples was measured down to 0.37°K and a value of 720 gauss/deg was obtained for $(dH/dT)_{T = Tc}$. Consideration is given to the values of the electronic specific heat coefficients derived from the critical magnetic field data for uranium and titanium. A.

537.312.62

9699. SUPERCONDUCTING ALKALINE EARTH COMPOUNDS. B.T.Matthias and E.Corenzwit.
Phys. Rev., Vol. 107, No. 6, 1558 (Sept. 15, 1957).

Intermetallic compounds between alkaline earths and noble metals are reported. They crystallize in the cubic Laves phase. Superconductivity is found in the rhodium and iridium systems. A.

537.312.62

9700. THE PASSAGE THROUGH THE CRITICAL TEMPERATURE-FIELD REGION FOR A SUPERCONDUCTOR IN A MAGNETIC FIELD. W.Meissner.
Z. Phys., Vol. 148, No. 5, 607-11 (1957). In German.

Discusses in general terms the possibility that a metal in the fully superconducting state may contain some sort of domain structure, and discusses also some consequences of Näbauer's work (see following abstract). R.G.Chambers

537.312.62

9701. THEORETICAL INVESTIGATION OF THE STABILITY OF A CYLINDRICAL PHASE BOUNDARY BETWEEN SUPER AND NORMAL CONDUCTOR IN A CIRCULAR MAGNETIC FIELD. A. BEHAVIOUR FOR VIRTUAL, INFINITESIMAL, SPATIALLY PERIODIC UNDULATIONS OF THE BOUNDARY SURFACE. M.Näbauer.
Z. Phys., Vol. 148, No. 5, 612-30 (1957). In German.

If a toroidal coil is wound over a hollow cylindrical superconductor, the cylindrical phase boundary produced by the resultant circular field is found experimentally to be stable (Näbauer, Abstr. 371/1956). It is now shown that on the London—von Laue theory it should be unstable, if the effect of interphase surface energy is neglected. R.G.Chambers

537.312.62

9702. THE STABILIZATION OF THE INTERMEDIATE STATE IN A SUPERCONDUCTOR CARRYING CRITICAL CURRENT. W.Buckel and R.Hilsch.
Z. Phys., Vol. 149, No. 1, 1-14 (1957). In German.

The specimens used were evaporated films of tin, having a resistance R_n in the normal state of 10 ohms or more. If the source impedance is small compared with R_n, the current flowing is controlled largely by the specimen resistance R, which is then found to vary continuously and reversibly from zero to R_n as the source e.m.f. is increased, instead of discontinuously and with hysteresis as in previous work. The observed characteristics are reproduced theoretically by assuming that at a critical current I_c, which like H_c depends parabolically on temperature, R can have any value from zero to R_n, and assuming that the specimen is linked to the bath by a finite thermal resistance, so that dissipation raises its temperature and lowers I_c until equilibrium is reached. Load-lines are drawn to show how hysteresis arises for high source impedance, and it is suggested that the discrepancy between the theoretical and experimental behaviour of thin wires may be explained in this way. R.G.Chambers

537.312.62 : 536.2.02

THE THERMAL CONDUCTIVITY OF A SUPERCONDUCTOR. See Abstr. 9651

537.321

9703. FRIEDEL THEORY OF THERMOELECTRIC POWER APPLIED TO DILUTE MAGNESIUM ALLOYS. E.I.Salkovitz, A.I.Schindler and E.W.Kammer.
Phys. Rev., Vol. 107, No. 6, 1549-52 (Sept. 15, 1957).

A brief review is given of several theories of the thermoelectric power of alloys. The Friedel theory which states that the parameter $\Delta X = -(E_F - E_0)(\partial \log \Delta\rho/\partial E)$ is a constant is found to hold over a relatively wide range of compositions. The constant takes on values which depend upon the valence of the solute atom. A dependence upon the atomic number (or period) of the solute is also indicated. A.

537.365 : 534.232

ELECTROKINETIC HYDROPHONE USED AT 9 kc/s. See Abstr. 9580

ELECTRIC DISCHARGES 537.52

537.523.4

9704. TEMPERATURE DISTRIBUTION IN THE PLASMA OF LOW- AND HIGH-VOLTAGE SPARK DISCHARGES. D.B.Gurevich and V.K.Prokof'ev.
Optika i Spektrosk., Vol. 2, No. 4, 417-20 (1957). In Russian.

The low- and high-voltage discharges (250 V and 6.5 kV respectively) between iron electrodes were examined spectroscopically by a diffraction grating and photomultiplier detector coupled to an oscilloscope. Oscillograms of the Cu I (5106 and 5153 A) and N II (5045 and 5179 A) lines were taken at various positions across the discharge and the results are presented as plots of temperature against time from the beginning of the discharge. L.Bovey

537.523.5 : 536.5 : 621.316.5.014.31

9705. MEASUREMENTS OF RADIAL TEMPERATURE DISTRIBUTION IN AN ELECTRIC ARC, STABILIZED WITH WATER AND "EXPANSIN". B.Gross.
Elektrotech. Obzor, Vol. 46, No. 3, 153-9 (1957). In Czech.

A high-speed photographic method for the determination of radial distribution of temperatures in an a.c. arc is described. The relative intensity emitted by the arc in the violet spectrum of wavelength components $\lambda = 3670 \pm 80$ angstrom was used for the determination of temperatures, and an interference filter permeable for this wavelength applied. Photographs of d.c. arcs of 150 A and a.c. arcs of 150 A and 330 A are recorded. Channel stabilization was created by eddies. The results are plotted in intervals which are multiples of 5.62°. The maximum temperature was, in the case of stabilization in water at 150 A, 21 000°K, and at 330 A, 40 000°K. The electrical conductivites of the arcs were determined. Hysteresis phenomena of temperature and conductivity in respect to current density are studied. E.Erdélyi

537.523.5 : 535.331

EMISSION AND TEMPERATURE OF AN A.C. ARC. See Abstr. 9595

537.525 : 535.33

9706. THE ION MOVEMENTS AND THE SHAPE OF THEIR [SPECTRAL] LINES IN THE POSITIVE COLUMN OF A DISCHARGE. I. DIRECTED ION MOVEMENT IN A LOW-PRESSURE DISCHARGE. Yu.M.Kagan and V.I.Perel'.
Optika i Spektrosk., Vol. 2, No. 3, 298-303 (1957). In Russian.

From kinetic considerations formulae are derived giving both the drift and mean-square ion velocities in a direction along the electric field. The shape of the lines viewed at right angles to the tube axis is also considered theoretically. L.Bovey

537.525.6 : 538.569 : 621.372

9707. ON THE INTERACTION BETWEEN AN ELECTROMAGNETIC WAVE AND FREE ELECTRONS. T.Lom and M.Plecitý.
Slaboproudý Obzor, Vol. 18, No. 4, 191-5 (1957). In Czech.

By considering the motion of a single electron in a high-density electron plasma placed in a strong electromagnetic field, it is shown that the admittance of the plasma is

$$Y = G + jB = ne^2a(\nu + j\omega)/md(\omega^2 + \nu^2)$$

where m and e are the mass and charge of an electron, n is the electron density, ν is the collision frequency of the electrons, ω is the operating frequency and a and d are the cross-section area and the length of the interaction space. Admittance of the cathode-fall region of a neon discharge was measured in a waveguide at 9 kMc/s. From the experimentally determined values of G and B, parameters ν and n were evaluated (and plotted) as a function of the discharge current. The effect of microwave radiation on the d.c. parameters of gas discharges, in particular the cathode fall, was also studied. R.S.Sidorowicz

537.525.6 : 537.562

9708. ON THE PONDEROMOTIVE FORCES IN LOCALIZED PLASMA IN THE ELECTROMAGNETIC FIELD OF A PLANE WAVE. V.V.Yankov.
Zh. éksper. teor. Fiz., Vol. 32, No. 4, 926-7 (1957). In Russian.

A sphere of ionized gas, the ionization density being uniform, is considered by way of localization. For a sphere of radius a, and a wave-vector k, the analysis shows that forces arise, apart from radiation pressure, when $ka \ll 1$, tending to deform the plasma under the action of the field of the plane wave. There is instability of the surface layer of the sphere which promotes delocalization in all directions; this tendency is associated with the concentration of the region of localization into space considerably smaller than the e.m. wavelength. C.R.S.Manders

537.525.6 : 537.562

9709. THE MOTION OF ATTENUATED PLASMA IN AN ALTERNATING MAGNETIC FIELD. Ya.P.Terletskiĭ.
Zh. éksper. teor. Fiz., Vol. 32, No. 4, 927-8 (1957). In Russian.

A cylinder of plasma is considered, the axis being parallel to the direction of plasma movement. The conditions set up when a field is directed along the cylinder axis (the sources of the field being outside the cylinder) are worked out and it is shown too that, where the field is not strictly parallel to the axis but falls away with distance from the axis, forces come into play promoting stability of motion of the plasma particles. If on the other hand the field is set up by current directed parallel to the axis of symmetry of the cylinder then the many-fold increase in the kinetic energy of the electrons and ions discovered by Artsimovich (Atomnaya Energiya, Vol. 1, No. 3, 76, 1956) can be successfully accounted for. C.R.S.Manders

X-RAYS 537.531

537.531 : 621.386.2

9710. PRODUCTION OF SOFT X-RAYS IN A TUBE WITH A SPACE-CHARGE GRID. K.P.Lensch.
Ann. Phys. (Leipzig), Vol. 19, No. 6-8, 262-4 (1956). In German.

In X-ray microscopy, the X-ray tube is required to produce radiation in the 6 angstrom unit range. The total beam current from such a tube is usually limited by space-charge effects at the cathode. An X-ray tube is described in which a positive electrode near the cathode reduces the space-charge effect and permits a higher output compared with the usual diode tube. T.Mulvey

537.531 : 621.386.1

9711. SOURCES OF SHORT X-RAY FLASHES FOR INVESTIGATION OF RAPID PROCESSES.
V.A.Tsukerman and M.A.Manakova.
Zh. tekh. Fiz., Vol. 27, No. 2, 391-403 (1957). In Russian.

Various impulse X-ray tubes with the anode in the form of a needle are described for work with voltages of 1000-2000 kV. Small dimensions of the effective focus enable clear X-ray photographs to be taken of rapidly moving objects using $1.5\text{-}2.5 \times 10^{-7}$ sec flashes. Apparatus comprising four and eight X-ray tubes for radiography of the successive phases of development of a rapid process is described. Z.Krasucki

CATHODE RAYS. POSITIVE RAYS 537.533/.534

537.533

9712. SPACE CHARGE PHENOMENA IN A BETATRON.
H.W.Schmidt.
Ann. Phys. (Leipzig), Vol. 19, No. 6-8, 298-303 (1956). In German.

Experiments are described which indicate that the damping of the radial oscillations of the captured electrons can be explained by the existence of an azimuthally varying space charge.

J.W.Sturgess

537.533

9713. A MEANS OF AVOIDING THE "ELECTRON REST MASS" LIMITATION IN A MICROTRON. D.K.Aitken.
Proc. Phys. Soc. A, Vol. 70, Pt 7, 550-1 (July, 1957).

It is shown that, if the total energy in the first orbit is made equal to the energy increment between successive orbits, the increment is no longer limited to one electron rest-energy and need have no simple relation to it. This could be achieved by placing an emitter within the accelerating resonant cavity at such a point that an electron leaving the emitter would gain one rest-mass less than an electron completely traversing the cavity. The practical problems involved are discussed. J.H.Fremlin

537.533.08 : 539.166.08

9714. A LEAD FLUORIDE TOTAL-ABSORPTION SPECTROMETER FOR HIGH-ENERGY ELECTRONS AND PHOTONS.
W.S.C.Williams and H.S.Caplan.
Nature (London), Vol. 179, 1185-6 (June 8, 1957).

A total-absorption spectrometer is described using a crystal of lead fluoride. A high-energy electron or photon is absorbed in the crystal and visible light is emitted entirely in the form of Cherenkov radiation; this is detected by a photomultiplier. The performance is compared with that of other spectrometers using glass absorbers. T.Mulvey

537.533.2 : 539.576

9715. THE ELECTRON EMISSION FROM MECHANICALLY WORKED METAL SURFACES UNDER AN OXYGEN PRESSURE WHICH VARIES WITH TIME. J.Lohff.
Naturwissenschaften, Vol. 44, No. 7, 228 (1957). In German.

The emission, as measured with a secondary emission multiplier, was studied after scratching the surface with a wire brush. Experiments on aluminium at oxygen pressures varying between 1×10^{-5} and 50×10^{-5} mm O_2 showed that the emission depends on the oxygen pressure. The results indicate that the emission law previously assumed (Abstr. 2162/1956), which states that the number of electrons emitted per second is proportional to the rate of oxidation, is not strictly true. B.T.M.Willis

537.533.2 : 539.234

9716. ON THE ELECTRON EMISSION FROM EVAPORATED METAL LAYERS. J.Wüstenhagen.
Naturwissenschaften, Vol. 44, No. 7, 228-9 (1957). In German.

The emission was studied from aluminium layers 100 A thick under oxygen pressures from 5×10^{-7} mm to 4×10^{-5} mm. It was less the smaller the pressure. The emission from Al and Be fell sharply when the oxygen flow was interrupted, and on returning to the original pressure was the same as if no interruption had occurred. No change in the emission from Al and Be was observed on introducing spectrally pure nitrogen. Thus the behaviour of evaporated layers is the same as that of scratched surfaces (see preceding abstract). B.T.M.Willis

537.533.35 : 548.74

9717. COMBINATION OF EMISSION [ELECTRON] MICROSCOPE AND REFLECTION-DIFFRACTION CAMERA.
R.Arnal and C.Gonçalves.
C.R. Acad. Sci. (Paris), Vol. 244, No. 26, 3139-41 (June 24, 1957). In French.

The electron diffraction pattern of a selected area of a metal specimen is viewed at the same time as its magnified image (× 40) obtained by electron emission. This is achieved by using the heated specimen as the cathode of an electrostatic immersion objective whose axis lies at right angles to the diffraction camera axis. The instrument is used to study the influence of crystal structure on thermionic emission, and enables the surfaces giving diffraction patterns to be localized. A.E.I. Research Laboratory

537.533.35 : 539.165.08

9718. SLIT DESIGN FOR AXIALLY FOCUSING BETA-RAY SPECTROMETERS. D.B.Beard.
Rev. sci. Instrum., Vol. 28, No. 5, 385-6 (May, 1957).

A proposed entrance geometry for an axially-focusing beta-ray spectrometer is discussed in mathematical detail. The performance of the slit system depends on the rate of change of the angular position of the electrons with angular distribution of the electrons' initial velocity vector at the two ends of the beam defocusing fins. D.R.Chick

537.533.74

9719. MONTE CARLO CALCULATION OF THE MULTIPLE SCATTERING OF THE ELECTRON.
T.Sidei, T.Higasimura and K.Kinosita.
Mem. Fac. Engng Kyoto Univ., Vol. 19, No. 2, 220-8 (April, 1957).

The behaviour of an electron in a thick Al layer is studied by the Monte Carlo method, describing the electron by an approximate model, and the penetration and backscattering probability are obtained from a set of hundred histories. The consistency of the value of the practical range of the electron obtained by this calculation with that of the empirical formula proved that the method is quite adequate for solving the penetration and backscattering problem of the electron through a thick layer. A.

537.533.74

9720. INELASTIC SCATTERING OF 20-keV ELECTRONS IN METAL VAPORS. L.B.Leder.
Phys. Rev., Vol. 107, No. 6, 1569-78 (Sept. 15, 1957).

The low-energy losses of 20 keV electrons passing through the vapours of Zn, Cd, Hg, Na, K, Mg, Ca, Sb, Pb, and KCl, were measured by using an electrostatic analyser previously used for measuring electron energy losses in thin metal films. The atomic transitions corresponding to the measured energy losses are in many cases fairly easily established. However, there remain some which are questionable due to the fact that there is more than one feasible transition with energy differences of the order of the given energy loss. It is established that the principal interaction results in the excitation from the ground state of the neutral atom to the first excited level — the resonance excitation. It is also found that dipole excitations predominate. A.

537.533.75

9721. ON THE SOLUTIONS OF THE FLUCTUATION PROBLEM IN CASCADE SHOWERS. J.W.Gardner.
Nuovo Cimento (Ser. 10), Vol. 5, No. 5, 1368 (May, 1957).

Comments on a paper by Messel (Abstr. 2309/1957). Points out that Messel's proposed method for computing the longitudinal number distribution function is not in general superior to previous methods since, like these, it requires a knowledge of the factorial moments whose computation is a considerable project even by automatic means. J.W.Gardner

537.533.75

9722. PENETRATION OF ELECTRON BEAMS INTO WATER BELOW THE CRITICAL ENERGY. I.Adawi.
Phys. Rev., Vol. 107, No. 6, 1476-82 (Sept. 15, 1957).

The "moments technique" is applied to the calculation of the spatial distribution of the energy dissipation in water by electron

beams of energies 10-25 MeV. A continuous energy loss is assumed and the energy–range relationships are obtained taking into account the ionization and radiation losses. These relationships are introduced in the proper Boltzmann transport equation to approximate the scattering term by a simple function of residual range. The stopping power is approximated by a sum of powers of residual range. This leads to expressing the spatial moments of the energy dissipation as a combination of triple moments of the electron distribution function. These triple moments are the angular, spatial and residual range moments, which are connected by a recursion system. The first three moments are calculated together with the boundary condition and the asymptotic trend. With this information, the distribution is constructed by using a simple analytical function. The agreement with experimental results is satisfactory. A.

537.533.8

9723. THE THEORY OF SURFACE EFFECTS IN SECONDARY EMISSION. W.Brauer and W.Klose.
Ann. Phys. (Leipzig), Vol. 19, No. 3-5, 116-32 (1956). In German.

A theoretical investigation of the contribution of surface-bound electrons to secondary emission. At primary energies E_p^0 of about 100 eV, about 30% of the yield can be accounted for in the case of light metals such as potassium. At higher values of E_p^0 and for heavier metals the contribution is negligible. M.R.Hopkins

537.533.8

9724. ENERGY DISTRIBUTION OF SECONDARY ELECTRONS FROM MgO SINGLE CRYSTALS. N.R.Whetten and A.B.Laponsky.
Phys. Rev., Vol. 107, No. 6, 1521-4 (Sept. 15, 1957).

The secondary-electron energy distribution from single crystals of MgO was measured. A dependence of energy distribution on primary electron energy is established. The dependence is consistent with a qualitative interpretation based on the path length of the secondaries inside the crystal. The single-pulse measurements method was modified to permit greater sensitivity, so that 10^4 electrons per pulse were sufficient for a 30 : 1 signal-to-noise ratio. Two procedures for establishing the surface potential are compared. Vacua of the order of 10^{-10} mm were employed. A.

537.533.9 : 539.172.4

9725. STUDY OF THE LIGHT EMITTED IN THE MODERATOR OF A HEAVY-WATER ATOMIC PILE. D.Breton and J.L.Delcroix.
C.R. Acad. Sci. (Paris), Vol. 245, No. 8, 842-5 (Aug. 19, 1957). In French.

The optical spectrum and its intensity variation with the pile's power showed that it was Cherenkov radiation. This was mainly due to Compton electrons produced by the γ-rays from the pile. D.H.Lord

537.533.9 : 539.16.08

9726. ČERENKOV-PHOTOVOLTAIC MONITOR FOR HIGH-INTENSITY RADIATION.
C.C.Thomas, Jr, K.H.Sun and E.A.Marusich.
Nucleonics, Vol. 15, No. 4, 98-101 (April, 1957).

Cherenkov radiation produced by 2 MeV electrons in water was detected using a selenium-barrier-layer photocell. The device may used as a high-intensity radiation monitor and, owing to its insensitivity to neutrons, is suitable for reactor shielding measurements. R.D.Smith

537.534

9727. AN EXPERIMENTAL PROTON LINEAR ACCELERATOR USING A HELICAL WAVEGUIDE.
D.R.Chick, D.P.R.Petrie, D.G.Keith-Walker and H.Longley.
Nature (London), Vol. 180, 432 (Aug. 31, 1957).

The construction of a proton linear accelerator using a helix as the slow wave structure is briefly described. The results obtained indicate that this type of structure can be used to accelerate heavy particles, though with the present design the beam-current efficiency is low. D.R.Chick

537.534 : 539.18

9728. LOW-ENERGY MESON BEAM FROM CYCLOTRON.
D.Koppel, R.Bingham and E.T.Booth.
Rev. sci. Instrum., Vol. 28, No. 8, 645-6 (Aug., 1957).

For experimental purposes an external meson beam of as low as 31 ± 2.5 MeV kinetic energy was obtained from a 385 MeV cyclotron by the use of a steel magnetic shield between the vacuum chamber and the concrete shielding. This was achieved with comparatively little loss of intensity over that obtained at 63 MeV mean energy of mesons obtained through the same hole in the concrete shield without the use of the magnetic shielding. A.

537.534.74

9729. ON THE PHASE-SHIFT ANALYSIS OF HIGH-ENERGY p–p SCATTERING. R.J.N.Phillips.
Nuovo Cimento (Ser. 10), Vol. 5, No. 5, 1335-7 (May, 1957).

It is argued that a unique set of phase-shifts at 140 MeV cannot be obtained until either triple scattering or spin correlation experiments have been done at this energy. The point is illustrated by a table of four distinct sets of phase-shifts, each consistent with existing data. J.M.Cassels

537.534.75

9730. ON THE PENETRATION OF IONS OF MEDIUM ENERGY IN MATTER. M.M.Bredov and N.M.Okuneva.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 4, 795-6 (1957). In Russian.

Measurements of the penetration of caesium ions of 4 keV in germanium are reported. The irradiation was carried out with a mass-spectrographic device, where some radioactive isotope Cs^{134} was added to the normal caesium in the ion source. The irradiated samples were then dissolved in a solution of hydrogen peroxide, and the weight as well as the activity of the samples measured at various stages of this process. Under these conditions the penetration of caesium in germanium was found to be $\sim 0.1\,\mu$ (which may be accounted for entirely by the kinetic energy of the ions). G.Martelli

537.534.75

9731. PASSAGE OF IONS OF VARIOUS GASES THROUGH A THIN SILVER FOIL. V.G.Tel'kovskiĭ and V.I.Pistunovich.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 5, 1035-8 (1957). In Russian.

The preparation of thin silver foils ($\sim$40 mμ) of very accurate thickness ($\pm$2%) is first briefly described. Absorption measurements of ions H^+, He^+, C^+, N^+ and O^+ with energies ranging from a few keV to some tens of keV respectively have been carried out with the help of a large magnetic spectrometer used as analyser. A short description of the experimental technique and accurate results of the velocity losses as a function of the velocity of the ions are given. G.Martelli

DISCHARGE TUBES. COUNTERS 537.54

537.542

9732. HIGH-PRESSURE PROPORTIONAL COUNTER.
T.E.Gilmer, Jr, R.Mace and E.D.Palmatier.
Rev. sci. Instrum., Vol. 28, No. 8, 634-5 (Aug., 1957).

A large-volume high-pressure proportional counter used in a study of the ionization energy losses of mu mesons is described. The details of construction for operation at $\sim$ 100 atm are given. A.

537.542 : 539.185.08

9733. DELAY-LINE CHAMBER HAS LARGE AREA, LOW CAPACITANCE. W.N.Hess, H.W.Patterson and R.Wallace.
Nucleonics, Vol. 15, No. 3, 74, 76-9 (March, 1957).

In order to obtain a large pulse from a large multi-plate ion chamber, alternate plates were connected by 200 μH inductances which, together with the interplate capacitances, formed a delay line. One end of the line was resistance terminated and the other connected via a step-up transformer to a pulse amplifier. The delay in the chamber limits its use in normal coincident circuits to a resolving time greater than 5 μsec, but this could be reduced by using a double-pulse circuit operating on pulses from both ends of the chamber. A bismuth fission chamber, constructed on this principle as a sensitive detector of high-energy neutrons, had a coated area of 63000 cm^2, and gave fission pulses of 100 μV amplitude at the amplifier input. The chamber was tested in a high-energy neutron beam from the UCRL Bevatron, and the gamma-ray background, determined by comparison with a similar chamber with uncoated plates, was shown to be small. R.D.Smith

537.542 : 539.164.08

9734. ALPHA-SCINTILLATION MONITOR FOR HANDS AND CLOTHING. J.Nicholls.
Nucleonics, Vol. 15, No. 3, 80-1, 83-4 (March, 1957).

A sensitive α-scintillation counter was developed using a large-area zinc sulphide screen formed by suspending phosphor in a cold-setting plastic and evaporating an aluminium reflecting film on to the surface. The light was collected from the 35 in^2 screen with a special parabolic reflector designed using a flying-spot scanning system so as to give uniform efficiency of light collection. R.D.Smith

537.542 : 539.166.08

9735. SCINTILLATION DOSE-RATE METER IS RELIABLE, EASY TO MAINTAIN. W.G.Spear.
Nucleonics, Vol. 15, No. 5, 96-101 (May, 1957).

Full details of a portable γ-dose-rate meter using a crushed anthracene crystal. The meter covers 0-1000 mr/hr in three ranges. Energy dependence curves from 23 keV to 2 MeV and angular response curves are given. R.D.Smith

537.542

9736. THALLIUM ACTIVATED CsI FOR SCINTILLATION SPECTROSCOPY.
W.Beusch, H.Knoepfel, E.Loepfe, D.Maeder and P.Stoll.
Nuovo Cimento (Ser. 10), Vol. 5, No. 5, 1355-7 (May, 1957).

The linear absorption coefficients and photocoefficients of CsI:Tl are at all energies at least 20% higher than those of NaI:Tl. The effective photofraction is especially favourable to CsI:Tl in the range 1-2 MeV. The light efficiencies of CsI:Tl and NaI:Tl are comparable. J.Franks

537.542 : 537.533.9

9737. THE EFFECT OF ULTRA-VIOLET CONVERTERS ON THE EFFICIENCY OF LIQUID ČERENKOV COUNTERS. N.A.Porter.
Nuovo Cimento (Ser. 10), Vol. 5, No. 2, 526-7 (Feb., 1957).

For a water-filled counter traversed by fast μ-mesons no effect accompanied the addition of fluorescein or Uvitex, but slightly alkaline solutions of β-methyl umbelliferone (0.005 – 0.1 g/litre) increased the mean pulse-height by about 100%. The absence of any increase for Compton electrons indicates that it is not due to scintillation. K.H.Barker

IONIZATION. THERMIONICS 537.56/.58

537.561

9738. SUCCESSIVE IONIZATION POTENTIALS OF UNSATURATED HYDROCARBONS. N.S.Hush.
J. chem. Phys., Vol. 27, No. 3, 612-13 (Sept., 1957).

The second π-ionization potentials, corresponding to the process $R^+ \rightarrow R^{++} + e$, are calculated for a number of unsaturated hydrocarbon molecules R. The SCF LCAO molecular orbital method, together with semiempirical values proposed by Pariser and Parr and Hush and Pople for interaction and core integrals, has been employed. The value obtained for benzene (16.9 eV) is in good agreement with that reported by Hustrulid, Kusch, and Tate (17.2 ± 1.0 eV). A.

537.561

9739. STUDY OF THE MASS SPECTRA OF THE LOWER ALIPHATIC ALCOHOLS. L.Friedman, F.A.Long and M.Wolfsberg.
J. chem. Phys., Vol. 27, No. 3, 613-22 (Sept., 1957).

Mass spectra and appearance potentials were determined for methanol, ethanol, and propanol. These data are used in semi-empirical application of the statistical theory of mass spectra. The theory facilitates assignment of plausible mechanisms for the production of the various ion fragments. It is possible to obtain computed spectra in agreement with experimental data using an internally consistent set of structural parameters. A.

537.561 : 539.132

9740. IONIZATION POTENTIALS OF HYDROGEN FLUORIDE AND THE GROUND STATE OF THE HF^+ ION.
J.A.R.Coope, D.C.Frost and C.A.McDowell; J.W.C.Johns and R.F.Barrow.
Nature (London), Vol. 179, 1186 (June 8, 1957).

Coope, Frost and McDowell, using mono-energetic electrons, find a first ionization potential for HF at 15.77 eV, and a second 1.2 eV higher; they conclude that the $A^2\Sigma$ state observed spectroscopically by Johns and Barrow is not the ground state, which is probably $^2\Pi_i$.

Johns and Barrow briefly discuss electronic states and potential energy curves of HF^+, and predict an infrared system $A^2\Sigma \rightarrow X^2\Pi_i$ with (0,0) band near 11 200 A and (1,0) band near 8500 A.

A.G.Gaydon

537.562 : 536.45

9741. A METHOD OF HEATING MATTER OF LOW DENSITY TO TEMPERATURES IN THE RANGE 10^5-10^6 °K. F.B.Knox.
Austral. J. Phys., Vol. 10, No. 1, 221-5 (March, 1957).

The feasibility of containing, by radiation pressure alone, a fully ionized gas of density 10^{17}-10^{18} atm/m^3 at temperatures between 10^5 and 10^6 °K is proposed and investigated. It is shown that hydrostatic equilibrium can be retained by radiation pressure at frequencies ~100 Mc/s in a spherical copper container in which three standing electromagnetic wave systems H_{101}, H_{102}, H_{103} with mutually orthogonal polar axes are maintained. Stability against change in shape appears probable, and eddy losses in the container should more than compensate for the heat radiation from the completely ionized gas. R.W.Nicholls

537.562

9742. STUDY OF PHOTOIONIZATION EFFICIENCIES USING A MASS SPECTROMETER.
H. Hurzeler, M.G.Inghram and J.D.Morrison.
J. chem. Phys., Vol. 27, No. 1, 313-14 (July, 1957).

An experimental method is outlined for measuring photoionization efficiencies by combining a vacuum ultraviolet monochromator and a mass spectrometer. Results are given graphically of the photoionization efficiencies for the processes $C_2H_5NH_2 \rightarrow C_2H_5NH_2^+$ and $C_2H_5NH_2 \rightarrow CH_2NH_2^+$ as a function of photon energy. J.Dutton

537.562

9743. ION CYCLOTRON RESONANCE. R.F.Saxe.
Nature (London), Vol. 180, 87-8 (July 13, 1957).

Cyclotron resonance has been observed from the protons in a low-pressure hydrogen discharge, at 750 kc/s in a field of about 500 G. R.G.Chambers

537.565

9744. MOBILITIES OF MERCURY IONS IN HELIUM, NEON, AND ARGON. L.M.Chanin and M.A.Biondi.
Phys. Rev., Vol. 107, No. 5, 1219-21 (Sept. 1, 1957).

The mobilities were measured at 300°K. The values obtained are μ_0 = 19.6 (He), 5.95 (Ne), and 1.84 (A) cm^2 V^{-1}-sec^{-1}. These values are in agreement with extrapolations of the mobility v. mass-number curves obtained for alkali ions in the noble gases by Tyndall and collaborators. The experimental values for Hg^+ are compared with the Langevin theory in the polarization limit. Good agreement is obtained only for the case of argon. A.

537.565

9745. DRIFT VELOCITIES OF IONS IN NITROGEN AT VARIOUS TEMPERATURES. F.R.Kovar, E.C.Beaty and R.N.Varney.
Phys. Rev., Vol. 107, No. 6, 1490-2 (Sept. 15, 1957).

Drift velocities of nitrogen ions in nitrogen gas as a function of field pressure were studied by a pulsed Townsend discharge method at temperatures of 77°K, 300°K and 450°K. Results support the theory that N_2^+ ions are responsible for drift velocities at high E/p_0 values, N_4^+ ions are responsible for drift velocities at low E/p_0 values, while the drift velocity at intermediate E/p_0 values is an average velocity determined by the relative lifetimes in transit of the N_4^+ and N_2^+ ions. Results further substantiate the existence of N_4^+ at low E/p_0 and N_2^+ at high E/p_0 by showing opposite temperature effects on the mobility of the two ions. The binding energy of the N_4^+ ion is estimated at 0.14 eV. A.

537.571

9746. IONIZATION CURRENTS IN ARGON AND HELIUM LIQUIDS. R.L.Williams and F.D.Stacey.
Canad. J. Phys., Vol. 35, No. 8, 928-40 (Aug., 1957).

Ionization currents in alpha-irradiated argon and helium I and II liquids were measured over an electric field range of 10^5 : 1, and conduction pulse amplitude distributions have been measured over a 300 : 1 range of applied field. A critical examination of theories of ion recombination shows that they are unable to explain the results of the present experiment, and a new approach to the problem of columnar recombination is suggested. A.

537.583 : 621.385.032.213.13

9747. THE EFFECT OF OXYGEN AND SULPHUR ON THE THERMIONIC EMISSION FROM MATRIX CATHODES.
J.F.Richardson.
Brit. J. appl. Phys., Vol. 8, No. 9, 361-2 (Sept., 1957).

The poisoning of the emission from matrix cathodes by oxygen and sulphur is reversible. Recovery of the emission is more rapid from oxygen poisoning. The shape of the recovery curves indicates that the poisoning agent is present on the surface and has also diffused into the cathode pores. A.

537.583 : 621.315.612.4

9748. THERMIONIC ELECTRON EMISSION OF FERROELECTRICS. N.D.Morgulis.
Zh. tekh. Fiz., Vol. 27, No. 2, 432-4 (1957). In Russian.

The suitability of $BaTiO_3$ as a cathode material has been tested. Three methods of preparation and activation are described. The

electron emission was measured both with d.c. and using a 100 μsec exponential pulse. The best results obtained (15 to 250 mA cm^{-2} at 1020 to 1200°K) compare favourably with a normal oxide cathode.
J.B.Arthur

COSMIC RAYS 537.591

537.591.1

9749. TRANSITION EFFECTS OF COSMIC RADIATION IN LEAD WITH PARTICULAR REFERENCE TO THE HARD COMPONENT. H.Burmeister.
Z. Naturforsch., Vol. 12a, No. 1, 10-18 (Jan., 1957). In German.

A counter arrangement was constructed for examining the the cosmic-ray transition curve under lead. The apparatus was suitable also for studying other components of the cosmic radiation. No effect was found which could be interpreted as a second maximum of the Rossi transition curve as reported elsewhere.
E.W.Kellermann

537.591.15

9750. AN EXPERIMENT ON AIR SHOWERS PRODUCED BY HIGH-ENERGY COSMIC RAYS. G.Clark, J.Earl, W.Kraushaar, J.Linsley, B.Rossi and F.Scherb.
Nature (London), Vol. 180, 353-6 (Aug. 24); 406-9 (Aug. 31, 1957).

Fifteen disk-shaped plastic scintillators, each 105 cm in dia. and 10 cm thick, were arranged in a circular area about 460 m in diameter. An analysis was made of the times of arrival of the shower front and the pulse height spectrum in order to determine accurately the size of the shower and the direction of arrival of the initiating particle. The largest recorded shower contained 1.4×10^9 particles corresponding to about 10^{19} eV. For showers with more than 2×10^6 particles it was confirmed that the primary particles are distributed isotropically but there was a possible lack of isotropy for very large showers with more than 3×10^7 particles. The lateral distribution function had no marked dependence on the size (N) or zenith angle of the showers, suggesting that the development of the shower is mainly determined by the nuclear cascade. Within the limits $10^6 < N < 10^8$ the integral size spectrum was given by $S(N,x_0) = (3.8 \pm 1.2) \times 10^{-12} (10^6/N)^{1.84}$ cm^{-2} sec^{-1} $sterad^{-1}$, where x_0 is the vertical atmospheric depth. The integral energy spectrum, in the range 4×10^{18} eV $< E < 10^{19}$ eV, was given by $J(E) = 2.2 \times 10^{-10} (10^{18}/E)^{2.13}$ cm^{-2} sec^{-1} $sterad^{-1}$. These results may point to an extragalactic origin of high-energy cosmic rays, but can also be explained by showers produced by heavy nuclei, or by a nearly spherical galactic halo of highly turbulent diluted gas carrying magnetic fields.
E.J.Burge

537.591.2

9751. ENERGY SPECTRUM OF THE SOFT COMPONENT NEAR SEA LEVEL. H.Carmichael.
Phys. Rev., Vol. 107, No. 5, 1401-9 (Sept. 1, 1957).

An analysis of the transition curves of Carmichael and Steljes (Abstr. 4515/1957) yields the transition curves in lead of ion-chamber bursts produced by cascades initiated by the electrons and photons of the soft component incident from the atmosphere. From the rates at the maxima of these transition curves, the absolute omnidirectional integral energy spectrum of the electrons and photons of the soft component at sea level, in the energy range from about 100 MeV to 100 BeV, is deduced. Incident electrons and photons associated with extensive air showers, as identified by coincidences with a nearby larger ion chamber, are excluded. An additional single experimental point on the integral spectrum (8.4×10^{-3} per sphere of unit area per sec) is obtained from the observed rate of electrons of all energies greater than 1 MeV which intersect the unshielded ion-chamber. Since a quantitative relation from electromagnetic cascade theory is made use of in the derivation of the energy spectrum, and since this relation is at present uncertain for lead in the energy range involved, the possible error of the flux in the energy spectrum (± 100%) is much larger than that of the observed rates of occurrence of bursts (±5%). In this respect the spectrum is preliminary only. In the energy range below 400 MeV the integral spectrum is in agreement with previous absolute measurements; below 2 BeV it is in conformity with a previous relative measurement; from 1.6 BeV to 100 BeV, where there are no previous determinations, it obeys a power law of exponent −2.00 and the rate for 1.6 BeV is 2.4×10^{-5} per sphere of unit area per sec.
A.

MAGNETISM 538

538.111

9752. REMARKS RELATIVE TO MAXWELL'S FORMULA FOR THE MAGNETIC SUSCEPTIBILITY OF DISSEMINATED MATERIALS. L.B.Slichter.
Advances in Phys., Vol. 6, 333-5 (July, 1957).

Paper delivered at the International Conference on Rock Magnetism, London, 1956. A restatement of Maxwell's solution of the problem of the effective electrical conductivity of a medium containing a dispersal of small conducting spheres, and here applied to the corresponding magnetic problem. It is concluded that an important part of the spread in the determination of the susceptibility of disseminated magnetic particles arises from uncertainties in the effective values of the demagnetization factors.
A.E.De Barr

538.22 : 539.219 : 536.631

SUSCEPTIBILITY OF Pd–Rh ALLOYS. See Abstr. 9664

538.221

9753. A NEW METHOD OF OBSERVING MAGNETIC TRANSFORMATIONS. M.Blackman, G.Haigh and N.D.Lisgarten.
Nature (London), Vol. 179, 1288-90 (June 22, 1957).

Magnetic transformations are demonstrated visually on the fluorescent screen of an electron diffraction camera, the electron beam, which is focused either above the specimen or on the screen, being affected by the stray magnetic fields emanating from the magnetic domains. Observations were made on single crystals of haematite, magnetite and pyrrhotite, and on powder specimens of maghemite, magnetite and haematite. A reversing ferrite was also investigated.
E.P.Wohlfarth

538.221 : 539.4

VARIATION OF MAGNETIC AND MECHANICAL PROPERTIES OF IRON DUE TO DISSOLVED HYDROGEN. See Abstr. 8911

538.222

9754. E.P.R. SPECTRUM OF SOLID NITROGEN AFTERGLOW AT 4.2°K. T.Cole, J.T.Harding, J.R.Pellam and D.M.Yost.
J. chem. Phys., Vol. 27, No. 2, 593-4 (Aug., 1957).

Intense electron-paramagnetic-resonance spectra were observed in solid N afterglow at 4.2°K, thus indicating the presence of atomic nitrogen. The E.P.R. spectrograph had automatic field control, and sweep was controlled by a proton resonance fluxmeter. Microwave radiation was at 9397 Mc/s. A magnetic field modulation of 1 gauss at 400 c/s produced the derivative of the required absorption curve. The E.P.R. spectrum consists in a distinct triplet, with splittings from the central line of $4.5 \pm 0.4 \times 10^{-4}$ weber/m^2; two weak satellites are also visible. Spectral intensity was found to remain sensibly constant throughout a period of 1 hr denoting a long half-life for the solid active N.
D.R.Barber

538.222

9755. MAGNETIC SUSCEPTIBILITY OF NpF_6. B.Weinstock and J.G.Malm.
J. chem. Phys., Vol. 27, No. 2, 594-5 (Aug., 1957).

Reports results of measurements between 64° and 295°K and obtains for the molar susceptibility $\chi = AT^{-1} + B$, $A = 0.0362$, $B = 3.21 \times 10^{-4}$. The results are interpreted by invoking the effect of the cubic crystalline field and spin–orbit coupling acting on the 5f electrons.
E.P.Wohlfarth

538.224

9756. ON THE VARIATION OF THE DIAMAGNETIC SUSCEPTIBILITY OF WATER DUE TO TEMPERATURE. T.Tietz.
Nuovo Cimento, Vol. 6, No. 2, 387-9 (Aug., 1957).

A calculation of the diamagnetic susceptibility of water using an approximate solution of the Thomas–Fermi equation for a free neutral atom.
A.E.De Barr

538.23

9757. INTERPRETATION OF THE CREEPING [REPTATION] OF HYSTERESIS CYCLES. L.Néel.
C.R. Acad. Sci. (Paris), Vol. 244, No. 22, 2668-74 (May 27, 1957). In French.

The effect is the continuous displacement of the hysteresis cycle of a specimen to which magnetic fields of different amplitudes H_A and H_B are successively applied. It is described by considering the action of a small field of spatially random amplitude additional to the applied fields, this field having its origin in the fluctuating interaction between the elementary domains of the specimen under the action of the successively applied fields.
E.P.Wohlfarth

538.23

9758. FORMAL MODEL OF MAGNETIC HYSTERESIS.
G.Biorci and D.Pescetti.
Nuovo Cimento, Vol. 6, No. 1, 242-4 (July, 1957).

Hysteresis loops calculated on the basis of the Preisach model are found to be in good agreement with observation. The distribution of the position of the elementary rectangular loops is found experimentally. A.E.De Barr

538.245 : 538.652

9759. MAGNETIZATION, MAGNETOSTRICTION AND RELAXATION PHENOMENA DURING ISOTHERMAL MAGNETIC ANNEALING AT HIGH TEMPERATURES IN Ni–Co ALLOYS.
H.Masumoto, H.Saitô and M.Takahashi.
Sci. Rep. Res. Insts Tôhoku Univ. A, Vol. 9, No. 4, 293-308 (Aug., 1957).

An apparatus for the precise measurement of magnetostriction and magnetization at high temperatures was constructed, and these magnetic properties in thermally demagnetized Ni–Co alloys have been measured at high temperatures. It was found that these properties showed a remarkable relaxation phenomenon. Their time changes at constant temperature were continuously traced under the external fields of various strengths from the instant of the application of the field onward. The amount of the time change in the magnetostriction becomes large when the strength of field during annealing is large and the annealing duration is long. The effect begins to appear at about 300°C and is most remarkable at about 350°C and then gradually decreases, vanishing finally at the Curie point. With progress of annealing, the negative magnetostriction becomes smaller and even turns positive in the case of alloys containing large amounts of cobalt, while the initially positive striction becomes larger. It may be considered that these relaxations are caused by a micro-creep phenomenon in a broad sense of the word, that is, by displacements of impurities or lattice defects due to the magnetostriction at high temperatures. A.

538.245

9760. MAGNETIZATION CURVES OF TUBULAR NICKEL SPECIMENS UNDER TORSION AND PRESSURE. K.Strnat.
Z. Naturforsch, Vol. 12a, No. 1, 76-9 (Jan., 1957). In German.

Hysteresis loops are given for nickel tubes under torsion, both longitudinal and circumferential components of the magnetization being considered. Similar loops are given for a hard nickel tube under longitudinal pressure. A.E.De Barr

538.27 : 536.48

9761. THE DE HAAS–VAN ALPHEN EFFECT OF ZINC.
T.Fukuroi and Y.Saito.
Sci. Rep. Res. Insts Tôhoku Univ. A, Vol. 9, No. 4, 273-92 (Aug., 1957).

The de Haas–van Alphen effect of pure zinc crystal was investigated at temperatures ranging from 63° to 1.3°K by means of a torsion magnetometer. In the magnetic field less than 16 kOe and at the temperatures 4.2°K and above, a remarkable periodic variation of magnetic susceptibility was found with the intensity of magnetic field and it is here referred to as the long-period effect. While in the field higher than 19 kOe and at temperatures from 4.2° to 1.3°K, it was observed that a shorter-period and smaller-amplitude effect, which is accompanied by some complicated beat structures, is superposed on the high-field extension of the long-period effect just cited. From the analysis of the long-period effect the de Haas–van Alphen parameters were obtained: $E_{0l} = 5.5 \times 10^{-14}$ erg, $M_{1l}/m_0 = 5.4 \times 10^{-3}$, $m_{3l}/m_0 = 2.7 \times 10^{-1}$, $T_{Dl} = 400°K$, $n_l = 1.2 \times 10^{-6}$ atom^{-1}; and from the analysis of the short-period effect: $E_{0S} = 7.9 \times 10^{-14}$ erg, $m_{1S}/m_0 = 1.6 \times 10^{-1}$, $m_{3S}/m_0 = 8.3 \times 10^{-2}$, $T_{DS} = 570°K$, $n_S = 3 \times 10^{-5}$ atom^{-1}. A.

ELECTROMAGNETISM. ELECTRODYNAMICS

538.3/.5

538.3 : 532.5

9762. HYDROMAGNETIC DISTURBANCES IN A FLUID OF FINITE CONDUCTIVITY. II. P.H.Roberts.
Astrophys. J., Vol. 126, No. 2, 418-28 (Sept., 1957).

For Pt I, see Abstr. 9782 (1955). Three-dimensional disturbances are investigated and it is shown that Green's functions may be derived, with the aid of which the course of an arbitrary disturbance may be followed. It is shown also that, along the direction of H_0, the disturbances are propagated in essentially the same manner as those discussed in Pt I, while in perpendicular directions it is transmitted almost entirely by diffusion, as though the conductor were solid. Walén's (1944) approximation is briefly examined and is exhibited as the first term of a series expansion of the exact solution. A.

538.3 : 532.5

9763. DYNAMO EFFECT IN HYDROMAGNETIC THEORY.
S.Colombo.
Rev. gén. Elect., Vol. 66, No. 6, 325-32 (June, 1957). In French.

In this general review the basic equations are derived and a report on recent theories is based on the work of Bullard, Gellman and Elsasser. R.A.Newing

538.3

9764. INVARIANT SURFACES OF ELECTRODYNAMICS.
M.Kohler.
Z. Phys., Vol. 148, No. 4, 443-53 (1957). In German.

The theory of Pfaffian forms is used to show that the linear form $\omega = \phi_k dx^k$, where ϕ_k is the 4-vector potential, can be expressed either as $\xi_1 d\eta_1$ or as $\xi_1 d\eta_1 + \xi_2 d\eta_2$, where ξ_1, ξ_2, η_1, η_2 are independent scalar functions. In the case $\omega = \xi_1 d\eta_1$, corresponding to $\vec{E}.\vec{B} = 0$, it is shown that the field defines a two-parameter family of invariant two-dimensional surfaces, this result being independent of the nature of the 4-vector current or of the space-time metric. For vacuum fields in Minkowski space-time there exists also a second family of surfaces orthogonal to the first. Electrostatic, magnetostatic and plane-wave fields are used to illustrate the theory. R.A.Newing

538.3

9765. ON HEREDITARY ELECTRODYNAMICS. M.Zăgănescu.
Z. Phys., Vol. 148, No. 4, 508-12 (1957). In German.

Volterra's integral equation for an induction dependent upon all previous values of the field intensity is generalized to space-time dependence, and is expressed in Lorentz invariant form. It is noted that the integro-differential equations for the field intensities may be derived from a variation principle. R.A.Newing

ELECTROMAGNETIC WAVES AND OSCILLATORS 538.56

538.56 : 532.51

9766. EXTENSION OF THE THEORY OF HYDROMAGNETIC WAVES AND APPLICATION TO INHOMOGENEOUS LAYERS.
E.Richter.
Z. Naturforsch., Vol. 11a, No. 11, 901-12 (Nov., 1956). In German.

General equations are formulated, without neglecting displacement currents, for a non-magnetic, non-viscous gyroelectric medium of finite conductivity and electrically neutral in its rest-frame. Solutions of linearized equations are considered for the case in which the material constants and field quantities are functions of a single spatial coordinate, and the results are used to obtain the reflection and transmission coefficients for undamped waves at a non-uniform layer. The dissipation of energy in a homogeneous medium is also considered. R.A.Newing

538.56 : 532.51

9767. APPLICATION OF ABRAHAM'S ENERGY-MOMENTUM TENSOR IN THE THEORY OF HYDROMAGNETIC WAVES.
E.Richter.
Z. Phys., Vol. 148, No. 2, 253-61 (1957). In German.

An investigation (see preceding abstract), in which displacement currents are taken into consideration, is modified by using the Abraham tensor in place of Minkowski's. It is now found that hydromagnetic waves exist even in the limiting case of zero conductivity. R.A.Newing

MOLECULAR AND ATOMIC STRUCTURE

539.1

THEORY OF SOLID STATE 539.11

539.11

9768. OUR KNOWLEDGE OF THE FERMI SURFACE.
R.G.Chambers.

Canad. J. Phys., Vol. 34, No. 12A, 1395-423 (Dec., 1956).

"Electron transport" Conference paper (see Abstr. 8734/1957). A general review of experimental methods of investigating the Fermi surface in metals, including magnetoresistance, cyclotron resonance (Azbel—Kaner type), the anomalous skin effect and the de Haas—van Alphen effect. Discusses the effects to be expected when the Fermi surface is multiply connected, and the question of lattice broadening of energy levels in a magnetic field.

R.G.Chambers

539.11 : 538.65 : 534.23

9769. A PROPOSAL FOR DETERMINING THE FERMI SURFACE BY MAGNETO-ACOUSTIC RESONANCE. A.B.Pippard.
Phil. Mag. (Eighth Ser.), Vol. 2, 1147-8 (Sept., 1957).

Bömmel (Abstr. 1002/1956) has observed that the attenuation of ultrasonic waves in a pure tin crystal at 4°K varies in an oscillatory manner with the strength of a magnetic field applied transversely. This is attributed to a new type of cyclotron resonance which concerns the spatial extension of electron orbits in the direction of wave propagation. A study of single crystals in all orientations should give detailed information about the Fermi surface.

D.M.Edwards

539.11

9770. ELECTRONIC BAND STRUCTURE OF BORON CARBIDE. M.Yamazaki.
J. chem. Phys., Vol. 27, No. 3, 746-51 (Sept., 1957).

The tight-binding approximation is applied to a study of electronic energy bands of the boron carbide B_4C crystal. The 60 x 60 determinantal secular equation for the energy is reduced by group-theoretical treatments of the spatial symmetry at certain special values of the wave vector k. Calculations are carried out at two points in the Brillouin zone. At the zone centre point there is a substantial energy gap, about 2.5 eV, between the occupied and unoccupied levels, and at the zone boundary point $k = (\pi/a)(1,1,1)$ this gap becomes very narrow, i.e., about 1 eV. Considering compatibility relations for the types of symmetry, there may be the energy gap, being substantially broad at the zone centre point and very narrow at the zone boundary point $k = (\pi/a)(1,1,1)$, between the all-filled valence and the all-empty conduction bands, in accordance with the existence of the complicated structure, the great hardness, and the appreciable electric conductivity of this crystal. A.

539.11

9771. RELATIVISTIC EFFECTS IN THE COHESIVE ENERGIES OF THE ALKALI METALS.
J.Callaway, R.D.Woods and V.Sirounian.
Phys. Rev., Vol. 107, No. 4, 934-9 (Aug. 15, 1957).

The relativistic corrections to the cohesive energies of the alkali metals are studied from two points of view. In the first, perturbation theory is applied to the second approximation to the Dirac equation. Calculations are made for potassium and caesium. The limitations of this approach are discussed. In the second, the quantum defect method is extended to include almost all relativistic effects. A relativistic analogue of Bardeen's expression for the effective mass ratio is derived. Application is made to caesium.

A.

539.11 : 535.14

QUANTUM OPTICS OF METALS. See Abstr. 9589

MOLECULES 539.13

539.132

9772. APPROXIMATE DETERMINATION OF THE "CENTRE" OF THE MORSE WAVE-FUNCTION. R.Grandmontagne.
C.R. Acad. Sci. (Paris), Vol. 244, No. 21, 2586-9 (May 20, 1957).
In French.

It is deduced that the centre of the wave-function proposed by Morse (1929) is at $r = r_e + \frac{1}{3}(\nu + \frac{1}{2})$. Results are discussed for various values of ν.

G.I.W.Llewelyn

539.132

9773. EVALUATION OF FORCE CONSTANTS OF TETRAHEDRAL HYDRIDES FROM RAMAN AND INFRARED DATA. C.W.F.T.Pistorius.
J. chem. Phys., Vol. 27, No. 4, 965-7 (Oct., 1957).

The force constants of 4 molecules and 4 ions of the type XH_4 belonging to the T_d symmetry are calculated by Wilson's F-G matrix method, using Raman and infrared data. Using a modified Urey—Bradley field, the force constants between nonbonded atoms are calculated separately and substituted in the main equations. Anharmonicity is not taken into account.

A.

539.132 : 535.343

FORCE CONSTANTS OF THE NITRITE ION. See Abstr. 9615

539.132

9774. ENERGY LEVELS OF SLIGHTLY ASYMMETRIC TOP MOLECULES. S.R.Polo.
Canad. J. Phys., Vol. 35, No. 8, 880-5 (Aug., 1957).

For the rotational analysis of the band spectra of slightly asymmetric tops it is convenient to have explicit expressions for the rotational energies in terms of the rotational quantum numbers. In the tables available at present the coefficients of the power series in the asymmetry parameter are only tabulated numerically for each individual rotational level. In the present work more general expressions are derived, giving the explicit dependence on J, K and the asymmetry parameter ϵ (including terms up to ϵ^5). First-order corrections for centrifugal distortion in terms of J, K and ϵ are also included.

A.

539.132 : 539.133

9775. INFRARED INTENSITIES AND BOND MOMENTS IN SULPHUR DIOXIDE. J.E.Mayhood.
Canad. J. Phys., Vol. 35, No. 8, 954-60 (Aug., 1957).

New values have been obtained for the intensities of the three fundamentals of sulphur dioxide. They are $A_1 = 317 \pm 8$, $A_2 = 376 \pm 20$, $A_3 = 2560 \pm 70$, in units of 10^{10} sec^{-1} cm^{-1} at S.T.P. The normal coordinate calculation gives values for the bond moment derivatives and for the molecular dipole moment which demonstrate that the amount of charge moving in all three vibrations is greater than that inferred from the equilibrium charge distribution. The involvement of unshared electrons is suggested.

A.

539.132

9776. INFRARED BAND CONTOURS. I. SPHERICAL TOP MOLECULES. W.F.Edgell and R.E.Moynihan.
J. chem. Phys., Vol. 27, No. 1, 155-9 (July, 1957).

The relationships between the absorption coefficient, the true average absorption coefficient, and the pressure independent "average" absorption coefficient are considered. It is found that the absorption coefficient will equal the pressure independent average absorption coefficient provided that certain conditions are fulfilled. These conditions may be satisfied for heavy spherical tops but not for light molecules. The average absorption coefficient is obtained for fundamental bands of spherical tops including the interaction between the rotational angular momentum and the vibrational angular momentum of degenerate modes. The form of the band envelope is described and found to be in general agreement with experimental bands. The separation between the P and R maxima is found to be proportional to $1 - \zeta$ and this relation may be used for computing Coriolis constants. The band envelopes for CF_4 are measured and zeta values obtained from the P—R separation. They are found to be in good agreement with the sum rule. Finally, the zeta value for the CO stretching vibration of $Ni(CO)_4$ is obtained from the 5 μ band envelope and conclusions are drawn regarding the form of the vibration.

A.

539.132

9777. MEASUREMENT OF VIBRATIONAL RELAXATION TIME OF CO BEHIND A SHOCK WAVE BY INFRARED EMISSION.
M.W.Windsor, N.Davidson and R.Taylor.
J. chem. Phys., Vol. 27, No. 1, 315-16 (July, 1957).

The relaxation time was inferred from time-resolved intensity measurements in emission of the 2.35 μ CO band excited in a shock tube. A relaxation time of 77 μsec at 1470°K (equivalent to 19 μsec at one atmosphere) was obtained. These preliminary measurements appear to support a two-stage excitation process and an inverse dependence of the relaxation time upon pressure.

R.W.Nicholls

539.132 : 536.7

9778. ISOTOPE EFFECTS ON THERMODYNAMIC FUNCTIONS OF HINDERED ROTATORS. W.H.Stockmayer.
J. chem. Phys., Vol. 27, No. 1, 321-2 (July, 1957).

Theoretical investigation of the applicability of Pitzer and Gwinn's approximation (1942) for the partition function of a hindered rotator, for the case of small isotope effects on an almost classical system. It is found that the approximation is useful for effects on heat capacity, but unreliable for effects on reaction rates or equilibria involving internal rotation.

J.Hawgood

539.132

9779. NORMAL FREQUENCIES OF TETRAMETHYLMETHANE. H.Murata and K.Shimizu.
J. chem. Phys., Vol. 27, No. 2, 599-600 (Aug., 1957).

The observed frequencies are assigned to the fundamental

modes of vibration with the aid of the calculated frequencies. The F-matrix elements used in calculation are listed and tables are given of the potential constants and calculated fundamentals.
R.C.Seymour

539.132

9780. SLIGHT SIMPLIFICATION OF PILLOW'S METHOD FOR THE APPROXIMATE CALCULATION OF WAVE-FUNCTIONS.
R.Grandmontagne.
J. Phys. Radium, Vol. 18, No. 5, 358-9 (May, 1957). In French.
Calculation of the wave-function for anharmonic vibration of a diatomic molecule by the method of Pillow (Abstr. 9631/1951) can be shortened by simplifying the expression for the effective centre of the Morse potential curve. J.Hawgood

539.132 : 535.343

9781. ON THE ROTATIONAL ANALYSIS OF BANDS OF THE $A\,^3\Pi_{0^+}$-$X\,^1\Sigma^+$ SYSTEM OF TlCl. R.F.Barrow.
Proc. Phys. Soc. A, Vol. 70, Pt 8, 622-3 (Aug., 1957).
An earlier analysis is modified and now gives results in good agreement with observations of the microwave spectrum.
R.F.Barrow

539.132

9782. ON THE VARIATION OF ELECTRONIC STRUCTURE WITH INTERATOMIC DISTANCE: LINEAR SYMMETRICAL H_3 AND H_3^+. A.Laforgue.
Cahiers de Phys., Vol. 11, 93-112 (March, 1957). In French.
Extension of theoretical work (Abstr. 6362/1955; 534/1956) to internuclear distances other than the equilibrium distance, with discussion of the variation with internuclear distance of the "diagram quantities" derived from the wave-function, of configuration interaction, correlation and the "insociability of orbitals", of the partial occupation of MO's, and of ionization and dissociation. J.Hawgood

539.132

9783. ELECTRONIC STRUCTURE OF AMMONIA.
A.B.F.Duncan.
J. chem. Phys., Vol. 27, No. 2, 423-9 (Aug., 1957).
A self-consistent field calculation of the normal state of the ammonia molecule is made in the molecular orbital approximation. The molecular orbitals are expressed as linear combinations of all valence and inner shell orbitals of the atoms, and all interactions of the ten electrons are included. The total molecule energy, −56.096 a.u. is 99.2% of the experimental value. The dissociation energy, 0.3308 a.u. is about 72% of the experimental value. The calculated dipole moment (1.486 Debye) is almost equal to the experimental value (1.46 D). The two lowest ionization potentials are calculated as 9.94 and 16.20 eV, and are probably within one eV of the experimental values. An equivalent orbital representation is obtained from the molecular orbitals, and directional features of distribution of electron density are discussed. The integrals over atomic orbitals were all evaluated by standard mathematical methods, which are discussed in an appendix. A.

539.132

9784. ELECTRONIC SPECTRA AND STRUCTURE OF THE CARBONYL GROUP. J.W.Sidman.
J. chem. Phys., Vol. 27, No. 2, 429-35 (Aug., 1957).
A theoretical treatment of the electronic structures of compounds containing the carbonyl group is developed. The method employs the self-consistent field (SCF) procedure to determine the best molecular orbitals, for the lowest configuration, which can be formed as linear combinations of the atomic orbitals (LCAO-MO). Semiempirical methods are used throughout to determine the numerical values of all core parameters and electronic repulsion integrals. By a judicious choice of parameters and integrals it is possible to describe semiquantitatively the π-electron ionization potentials, $n \rightarrow \pi$ and $\pi \rightarrow \pi$ electronic transition energies, and π-electronic contribution to the dipole moment of formaldehyde, glyoxal, and p-benzoquinone. The effect of configurational interaction (CI) upon the calculated transition energies is considered for the $n \rightarrow \pi$ and for the $\pi \rightarrow \pi$ transitions. A.

539.132

9785. THE GROUND ELECTRONIC STATES OF THE MOLECULES OF OXIDES OF THE GROUP II ELEMENTS.
I.V.Veits and L.V.Gurvich.
Optika i Spektrosk., Vol. 2, No. 2, 145-9 (1957). In Russian.
Experiments on dissociation equilibria of CaO and SrO showed that the dissociation constants were 114.8 ± 3.0 kcal/mol and 111.0 ± 3.0 kcal/mol respectively. From a discussion of these results it is concluded that the ground state is $^1\Sigma$ in both cases.
L.Bovey

539.132

9786. THE OSCILLATOR STRENGTHS OF THE $1s\sigma-2p\sigma$, $2p\sigma-2s\sigma$, $2p\sigma-3d\sigma$, AND $2p\sigma-2p\pi$ TRANSITIONS OF HeH^{2+}
A.M.Arthurs, R.A.B.Bond and J.Hyslop.
Proc. Phys. Soc. A, Vol. 70, Pt 8, 617-19 (Aug., 1957).
Calculations are made on transitions of HeH^{2+} which involve the transfer of the electron from one nucleus to the other. Results obtained using the exact wave-functions of Bates and Carson (Abstr. 3890/1956) are tabulated and briefly discussed. Accurate results could not be obtained from the LCAO approximations.
G.I.W.Llewelyn

539.132 : 537.561

THE GROUND STATE OF THE HF^+ ION. See Abstr. 9740

539.132

9787. ELECTRON SPIN RESONANCE ABSORPTION SPECTRA OF SOME ORGANIC FREE RADICALS. J.H.Lupinski.
J. chem. Phys., Vol. 26, No. 6, 1766 (June, 1957).
The energy levels of organic free-radicals (e.g. triphenylmethyl) are given by $E = \pm\{\frac{1}{2}g_e\mu_B H + a_o\Sigma I_o + a_m\Sigma I_m + a_p\Sigma I_p\}$. I is the nuclear spin quantum-number, the interaction parameters a are proportional to the density of the unpaired electron at the carbon atom to which the nucleus is bonded, subscripts o, m, p refer to ortho-, meta- and para-positions. Values of a_o, a_m and a_p are chosen by comparison with the observed spectrum. a_p is much smaller than a_o and a_m at variance with the result given by MO calculations. R.C.Seymour

539.132

9788. SECOND RELAXATION IN A SPIN SYSTEM AT ROOM TEMPERATURE. P.G.Tishkov.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 620-1 (1957). In Russian.
It is shown that there is a maximum in the magnetic loss when plotted against field strength for $Cr(NO_3)_3.9H_2O$, at room temperature, with parallel static and high frequency fields. The position of the maximum varies from 250 Oe at 48 Mc/s to 360 Oe at 160 Mc/s.
D.H.Whiffen

539.132

9789. THE PARAMAGNETIC ABSORPTION IN SOME MANGANESE SALTS IN PARALLEL FIELDS AT VERY HIGH FREQUENCIES. A.I.Kurushin.
Zh. éksper. teor. Fiz., Vol. 32, No. 4, 938-9 (1957). In Russian.
Paramagnetic losses at 9.377×10^9 c/s are plotted against the magnetic field value using parallel static and high-frequency magnetic fields for $Mn(NO_3)_2.6H_2O$ and $Mn(NH_4)_2(SO_4)_2.6H_2O$ at 291°K. Both salts show broad maxima at 1500 Oe which is contrary to the theory of Shaposhnikov (Abstr. 3829/1948) if the spin–lattice relaxation time is assumed independent of magnetic field strength.
D.H.Whiffen

539.132

9790. THEORETICAL ASPECTS OF QUADRUPOLE RESONANCE.
F.Lurçat.
Cahiers de Phys., Vol. 11, 169-79 (April, 1957). In French.
An interpretation is presented of the variation of quadrupolar resonance with temperature and with molecular movement. The behaviour of liquids is discussed and an analogy drawn between quadrupolar and magnetic resonance. G.I.W.Llewelyn

539.132

9791. PROTON RESONANCE SHIFTS IN NICKELOCENE.
H.M.McConnell and C.H.Holm.
J. chem. Phys., Vol. 27, No. 1, 314-15 (July, 1957).
Proton resonance in nickelocene, $Ni(C_5H_5)_2$, in the solid and in toluene solution gave shifts of 1.20 and 1.10 gauss in 3750 gauss respectively, the signal being at higher applied fields. The shifts are due to contact hyperfine shifts with the unpaired electron and rough calculations indicate 50% of the unpaired electron character to reside in the cyclopentadienyl rings. D.H.Whiffen

539.132

9792. MOLECULAR DIAMAGNETIC ANISOTROPY AND THE PROTON MAGNETIC RESONANCE SPECTRA OF CONDENSED AROMATIC HYDROCARBONS. G.Hazato.
J. chem. Phys., Vol. 27, No. 2, 605-6 (Aug., 1957).
Extension of theoretical work by Pople (Abstr. 589/1957) to take into account the fact that not all conjugated paths are single hexagons. Agreement with experiment is improved for naphthalene, anthracene and perylene. J.Hawgood

539.132

9793. NUCLEAR QUADRUPOLE RESONANCES IN NITROGEN COMPOUNDS. I. AMMONIA, DEUTEROAMMONIA AND TRIMETHYLAMINE. C.T.O'Konski and T.J.Flautt.
J. chem. Phys., Vol. 27, No. 3, 815-16 (Sept., 1957).

The pure quadrupole spectra of NH_3 at 2.6779 Mc/s, ND_3, $(CH_3)_3N$ and $(CH_2)_6N_4$ were observed in the solid at 77° K. In NH_3 the decrease of coupling constant compared to the gas is 12.6% and in ND_3 21%; these changes result from hydrogen bonding. D.H.Whiffen

539.132 : 539.133

9794. QUADRUPOLE COUPLING CONSTANT AND MOLECULAR STRUCTURE OF CO^{17}. B.Rosenblum and A.H.Nethercot,Jr.
J. chem. Phys., Vol. 27, No. 3, 828-9 (Sept., 1957).

539.132

9795. A METHOD FOR MEASURING THE [MAGNETIC RESONANCE] RELAXATION TIME T_1.
T.Ghose, S.K.Ghosh and D.K.Roy.
Nuovo Cimento (Ser. 10), Vol. 5, No. 6, 1771-2 (June, 1957).

Describes a modification of Carr and Purcell's technique (Abstr. 6788/1954) and reports measurements of T_1 for $FeCl_3$ solutions which suggest field-dependence. J.Hawgood.

539.132

9796. MOLECULAR ORBITALS FOR THE GROUND STATE OF THE H_2 MOLECULE. F.E.Harris.
J. chem. Phys., Vol. 27, No. 3, 812-13 (Sept., 1957).

539.132

9797. SEMILOCALIZED BOND ORBITAL TREATMENT OF THE ALLYL RADICAL. J.Higuchi.
J. chem. Phys., Vol. 27, No. 3, 825-6 (Sept., 1957).

539.132

9798. SUMMATION CONVENTION AND THE DENSITY MATRIX IN QUANTUM THEORY. B.H.Chirgwin.
Phys. Rev., Vol. 107, No. 4, 1013-25 (Aug. 15, 1957).

Projection operators may be used instead of vectors to represent the states of a quantum-mechanical system and the appropriate equation of motion is obtained. When a basis is used the basic vectors may be oblique or orthogonal. A formulation appropriate to an oblique basis is developed with the help of tensor methods and the summation convention. This is generalized to be applicable to systems containing N electrons subject to Pauli's exclusion principle. The projection operator corresponding to an arbitrary state is the density operator and is represented by N th-order tensor. The well-known tensor operation of contraction of indices applied to the density operator furnishes similar, reduced operators giving one-, two-, or more-particle properties of the system. The one-particle properties are of special interest in chemical systems, the corresponding reduced density matrix being called the charge and bond matrix by Löwdin. The full formulae for the reduction of the general density matrix are given, showing the origin of the Coulomb and exchange operators. When the symbolic equation of motion is expressed by means of components and the process of contraction (reduction) is applied, the equation of motion of the one-particle reduction is obtained as well as an expression for the energy of the system. In the special case of the Hartree—Fock approximation the time-dependent wave-equations for the one-particle orbitals are shown to satisfy the general equation of motion, suggesting that the energies of the individual orbitals need not be stationary. This approximation is characterized by the idempotent property of the one-particle reduced density matrix. This condition alone leads to a close restriction on the possible values of the charge and bond orders of a molecule. Specific formulae for the molecule butadiene show that these can be expressed in terms of two parameters only, in this case. A.

539.132

9799. THE METALLIC MODEL AND THE π-ELECTRON POLARIZABILITY OF THE BENZENE MOLECULE. M.A.Kovner.
Optika i Spektrosk., Vol. 2, No. 3, 304-9 (1957). In Russian.

The π-electron polarizability of benzene in the plane of the ring is calculated. Three models are used: free electrons in a well with infinitely high walls (Abstr. 8617/1953), electrons moving in a field with a cosinusoidal potential (Kovner and Irkhin, Zhurnal Fizicheskoĭ Khimii, Vol. 28, 368, 1954), and a field with a rectangular periodic potential (Kronig and Penney, Proc. Roy. Soc., Vol. 130, 499, 1931). S.Chomet

539.132

9800. DISPERSION FORMULA IN THE METALLIC MODEL OF A MOLECULE WITH CONJUGATED BONDS.
M.N.Adamov and I.S.Milevskaya.
Optika i Spektrosk., Vol. 2, No. 3, 399-401 (1957). In Russian.

In a previous work (Abstr. 2482/1957) the static π-electron polarizability of benzene and molecules of the type $C_{2m}H_{2m+2}$ was calculated. Analogous calculations for the optical polarizability are now reported and are in agreement with experimental results (Denbigh, Trans Faraday Soc., Vol. 36, 936, 1940). S Chomet

539.132

9801. ADDITIVITY OF TENSOR AND BOND POLARIZIBILITIES. M.F.Yuks.
Optika i Spektrosk., Vol. 2, No. 4, 494-501 (1957). In Russian.

Discusses the compounding of polarizibilities in hydrocarbons with illustrative examples from ethane, methane and the normal paraffins. J.W.Gardner

539.133

9802. DIPOLE MOMENT OF THE MOLECULAR COMPLEX BETWEEN TRIETHYLAMINE AND IODINE.
H.Tsubomura and S.Nagakura.
J. chem. Phys., Vol. 27, No. 3, 819-20 (Sept., 1957).

539.133

9803. DIPOLE MOMENT OF THE HDSe MOLECULE.
V.G.Veselago.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 620 (1957). In Russian.

The Stark resolution of four lines $2_{20}-2_{21}$, $4_{31}-4_{32}$, $9_{54}-9_{55}$ and $7_{43}-7_{44}$ was studied for the purpose of determining the dipole moment of HDSe (for the Se^{80} isotope only), the $7_{43}-7_{44}$ transition being detected with the frequency 22 229.8 Mc/s. The magnitude $\alpha = \mu_a(HDSe)/\mu_a(HDO)$ was found to be 0.68 ± 0.02. Now $\mu(HDSe) = \alpha\,\mu(HDO)\sin\delta_2/\sin\delta_1$, where δ_1 and δ_2 are angles between the a axis and the direction of the dipole moment for HDSe and HDO molecules, respectively. Since $\delta_1 \sim 45°$ and $\delta_2 \sim 20°30'$, while $\mu(HDO) = 1.84$ debye (Abstr. 1653/1950), the value obtained for $\mu(HDSe)$ is 0.62 debye, i.e. it differs widely from the result obtained by Jache, Moser and Gordy (Abstr. 7606/1956). F.Lachman

539.133

9804. MOLECULAR STRUCTURE OF TROPONE.
K.Kimura, S.Suzuki, M.Kimura and M.Kubo.
J. chem. Phys., Vol. 27, No. 1, 320-1 (July, 1957).

The structural parameters of tropone, which is the simplest compound with a cyclo-heptatriene ring, were determined by electron diffraction. The mean C—C distance is 1.410 A which is close to the value of 1.39 A found in tropolone; that of 1.40 A found also in tropolone and in cupric tropolone and tropolone hydrochloride; and that of 1.414 A found in sodium troponante. J.Thewlis

539.133

9805. MOLECULAR STRUCTURE OF BIS-[CYCLOPENTADIENYL MOLYBDENUM TRICARBONYL]. F.C.Wilson and D.P.Shoemaker.
J. chem. Phys., Vol. 27, No. 3, 809-10 (Sept., 1957).

ATOMS. NUCLEUS. ISOTOPES 539.15

539.152.1/.2

9806. QUADRUPOLE MOMENTS AND ZERO-POINT OSCILLATIONS OF THE SURFACE OF AXIALLY SYMMETRICAL NUCLEI. A.S.Davýdov and G.F.Filippov.
Zh. éksper. teor. Fiz., Vol. 32, No. 4, 945-7 (1957). In Russian.

The generalized equation of A.Bohr taking into account core oscillations and coupling between the core and external particles is solved for S-states, and energies are given for various values of the parameters. G.E.Brown

539.152.1

9807. A PERTURBATION THEORY APPROACH TO THE BRUECKNER THEORY OF NUCLEI AND TO THE WATSON SCATTERING APPROXIMATION. H.Kümmel.
Nuovo Cimento, Vol. 6, No. 1, 23-50 (July, 1957). In German.

By a perturbation expansion in which linked-cluster terms do not appear, one can obtain the Brueckner theory, starting from a "model problem". The relation between the "model" and the actual nucleus is given exactly. Through neglect of terms of the order 1/A, one obtains the Brueckner approximation. One obtains the Watson scattering theory when one considers, in addition, the transformation from the free nucleon problem. G.E.Brown

539.152.1

9808. MAGNETOHYDRODYNAMIC WAVES IN THE ATOMIC NUCLEUS. H.Alfvén.
Phys. Rev., Vol. 107, No. 2, 632 (July 15, 1957).

An order-of-magnitude calculation of the frequencies of possible magnetohydrodynamic resonances in the nucleus, assuming it to be a uniformly magnetized sphere. J.W.G.Wignall

539.152.1

9809. INTERACTION OF A NUCLEON WITH THE NUCLEUS. E.Vogt and J.Lascoux.
Phys. Rev., Vol. 107, No. 4, 1028-40 (Aug. 15, 1957).

The importance of nucleon–nucleon correlations and the Pauli principle in the excited states of nuclei is studied. It is shown that the polarized wave-functions defined in an earlier paper by Vogt describe: (a) the correlated motion appropriate to a pair of nucleons whenever the pair is in close proximity, and (b) the motion of a single nucleon, when averaged over the positions of the nucleons to which it is correlated, as that given by the shell model. By use of the second moment of the strength function the polarized states are shown to solve the Schrödinger equation approximately. Previous calculations on the second moment are extended to show that when the correlations are neglected the second moment is not only large but also strongly dependent on the form of the internucleon potential — particularly when this potential contains strong repulsion at small distances. The large result obtained for the second moment in each case is reduced to a reasonably small value — less than $(10\ \mathrm{MeV})^2$ — by introducing the nucleon–nucleon correlations combined with the Pauli principle. A.

539.152.1

9810. APPLICATION OF A COLLECTIVE MODEL TO Si^{29}. D.A.Bromley, H.E.Gove and A.E.Litherland.
Canad. J. Phys., Vol. 35, No. 9, 1057-85 (Sept., 1957).

A strong-coupling collective model is applied to a description of the low levels of Si^{29}. Detailed comparisons of the predictions of this model with static and dynamic properties of the low levels of the A = 29 isobaric system are made; experimental data on the level spectrum, ground-state magnetic moment, decoupling parameter, reduced widths for nucleon capture in deuteron-induced stripping reactions, as well as gamma- and beta-ray transition widths are used in the comparisons. These indicate that Si^{29} has an oblate shape with a spheroidicity parameter $\delta \cong -0.15$. Although agreement between experiment and theory is in some cases only qualitative, it is shown that current collective models have relevance for the description of nuclear properties in this mass range. A.

539.152.1 : 539.172.3

9811. PHOTONUCLEAR REACTIONS AND THE GIANT RESONANCE. I. V.De Sabbata.
Nuovo Cimento Suppl. (Ser. 10), Vol. 5, No. 1, 243-66 (1957).
In Italian.

Review article examining the usefulness of the above for distinguishing between the various nuclear models. The basic experimental data are surveyed: variation of resonance energy with atomic number, cross-section at maximum, resonance line width, $\sigma(\gamma,p)/\sigma(\gamma,n)$ ratio etc. Various theoretical models of the independent particle, shell and collective types are considered. It is concluded that it is not yet established which of the models is correct, although anisotropies in the photoproton and photoneutron angular distributions lend support to the shell model of Wilkinson (Abstr. 6463/1955). There are 53 references. R.H.W.Johnston

539.152.1 : 530.145

9812. TWO-PION EXCHANGE POTENTIAL. M.Konuma, H.Miyazawa and S.Orsuki.
Phys. Rev., Vol. 107, No. 1, 320-1 (July 1, 1957).

The adiabatic nuclear potential involving the exchange of two pions expressed in terms of the pion scattering cross-sections has been evaluated numerically. Results of analyses of low-energy experimental data in terms of this potential are given. L.L.Green

539.152.1 : 530.145

9813. ON THE CHARACTER OF THE FORCE BETWEEN NUCLEONS. A.Z.Dolginov.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 612-14 (1957). In Russian.

The general form of a potential depending on the vector operators r/r, σ_1, σ_2 and l and the scalar operators r, $\partial/\partial r$ and l^2 is considered. G.E.Brown

539.152.1

9814. A REVISED SEMIEMPIRICAL ATOMIC MASS FORMULA. A.G.W.Cameron.
Canad. J. Phys., Vol. 35, No. 9, 1021-32 (Sept., 1957).

A new mass formula has been constructed which contains volume and surface energies, each with a symmetry energy contribution, Coulomb and Coulomb exchange energies, and shell correction and pairing energies. A nuclear model with a trapezoidal radial-density distribution was used. The central density was assumed constant, and the dimensions were adjusted to fit the Stanford electron-scattering results. The symmetry energy coefficients were determined by a least-squares fit to the valley of beta stability. The volume and surface energy coefficients were determined by a least-squares fit to 89 odd–odd masses uniformly spaced in mass number. The shell correction and pairing energies were assumed to be independent functions of the proton and neutron numbers; they were empirically determined from the differences between masses computed from the formula without corrections and those tabulated by Wapstra and Huizenga. The median energy difference between the corrected formula and the Wapstra–Huizenga masses is about 300 keV. Some remarks are made concerning the implication of these results for nuclear deformations and fission thresholds. A.

539.152.1

9815. THE LOW LEVELS OF Si^{29}. D.A.Bromley, H.E.Gove, E.B.Paul, A.E.Litherland and E.Almqvist.
Canad. J. Phys., Vol. 35, No. 9, 1042-56 (Sept., 1957).

Information on the low levels in Si^{29} was obtained by studying the gamma radiation associated with the $Si^{29}(p,p'\gamma)Si^{29}$ inelastic-scattering reaction in the proton-energy range from 2.5 to 3.0 MeV and with the $Al^{29}(\beta^-)Si^{29}$ negatron decay. Angular-distribution measurements showed that the 2.03 MeV level in Si^{29} has spin 5/2, and are consistent with a 3/2 assignment to the 1.28 MeV level. The E2/M1E2 branching ratio for the de-excitation of the 2.03 MeV state was measured to be approximately 100. Log ft values of < 5.2, > 6.5, and 5.2 were determined for the branches of the Al^{29} decay to the 2.43, 2.03, and 1.28 MeV states in Si^{29}. A.

539.152.1

9816. EXCITED LEVELS IN ARSENIC 75 PRODUCED BY RADIATIVE CAPTURE OF PROTONS BY GERMANIUM 74. D.R.Chick and S.E.Hunt.
Nature (London), Vol. 180, 88-9 (July 13, 1957).

Thin separated targets of Ge^{74} were irradiated by protons from a Van de Graaff accelerator and the gamma-ray yield measured as a function of a proton energy. Twenty five resonances were observed in the energy range 1.0 to 2.7 MeV, and their half-widths measured. The yield was compared with that from a known resonance in the $F^{19}(p,\alpha\gamma)O^{16}$ reaction and approximate values for the cross-section obtained. D.R.Chick

539.152.1 : 539.166.2

9817. ON THE 8.06 AND 8.70 MeV STATES IN ^{14}N. C.Broude, L.L.Green, J.J.Singh and J.C.Willmott.
Phil. Mag. (Eighth Ser.), Vol. 2, 1006-10 (Aug., 1957).

The γ-rays emitted by the 8.06 MeV state in N^{14} have been examined using a scintillation spectrometer. The spin and parity of the 5.69, 5.10 and 4.91 MeV states in N^{14} are discussed. Angular distributions of the γ-rays from the 8.06 MeV state in N^{14} have been measured and it is shown that there is a substantial d-wave component at this resonance. L.L.Green

539.152.1

9818. CALCULATIONS OF THE ENERGY LEVELS IN DEFORMED NUCLEI. K.Kumar and M.A.Preston.
Phys. Rev., Vol. 107, No. 4, 1099-103 (Aug. 15, 1957).

The methods of calculating the energy levels in spheroidal nuclei are discussed. It is shown that the expansion of the perturbation in powers of the deformation parameter, β, leads to a very slowly convergent series representation of the matrix elements. An alternative method of expressing the perturbation, due to Moszkowski (Abstr. 8994/1955), which can allow a better calculation, is also discussed. A.

539.152.1

9819. ENERGY LEVELS IN CHROMIUM-52. M.Mazari, W.W.Buechner and A.Sperduto.
Phys. Rev., Vol. 107, No. 5, 1383-6 (Sept. 1, 1957).

The excited states of Cr^{52} were studied through the $Mn^{55}(p,\alpha)Cr^{52}$ reaction and by an investigation of inelastic proton scattering from chromium. A 6.51 MeV proton beam from an electrostatic generator and a high-resolution magnetic spectrograph were used. Excited states in Cr^{52} were found at 1.433, 2.368, 2.648, 2.767, 2.965, and 3.161 MeV. The Q-value for the ground-state transition in $Mn^{55}(p,\alpha)Cr^{52}$ is 2.568 ± 0.008 MeV. A.

539.152.1

9820. GROUND STATE AND EXCITED LEVELS OF Cl^{40}. I.Talmi.
Phys. Rev., Vol. 107, No. 6, 1601-2 (Sept. 15, 1957).

The level scheme of Cl^{40} is calculated by using matrix elements of the nuclear interaction determined from a previous analysis of nuclear energies. The value of the spin J = 2 obtained for the ground state is in agreement with experimental results. A.

539.152.1

9821. NUCLEAR ENERGY LEVELS IN Mn^{55}.
M.Mazari, A.Sperduto and W.W.Buechner.
Phys. Rev., Vol. 108, No. 1, 103-5 (Oct. 1, 1957).

Inelastically scattered protons from manganese targets bombarded with protons from an electrostatic accelerator were studied with the high-resolution magnetic spectrograph. Forty-three excited states in Mn^{55} were established in the region between the ground state and 4.0 MeV. The first five of these levels are at 0.127, 0.983, 1.289, 1.527, and 1.884 MeV. A.

539.152.1 : 539.166

9822. ISOMERIC STATE OF URANIUM-235.
F.Asaro and I.Perlman.
Phys. Rev., Vol. 107, No. 1, 318-19 (July 1, 1957).

This was found by collecting recoils from the α-decay of Pu^{239} and counting the electrons emitted ($\sim$1 keV) in a windowless proportional counter. The half-life was 26.5 ± 0.2 min. See also the following abstract. A.O.Stanesby

539.152.1 : 539.166

9823. 27-MINUTE ISOMER OF U^{235}.
J.R.Huizenga, C.L.Rao and D.W.Engelkemeir.
Phys. Rev., Vol. 107, No. 1, 319-20 (July 1, 1957).

A sample of U separated chemically and rapidly from a Pu^{239} solution emitted soft radiation ($<\sim$2 keV) with a half-life of 26.6 ± 0.3 min. A.O.Stanesby

539.152.2

9824. A NOTE CONCERNING THE ELECTRIC HEXADECAPOLE MOMENT OF THE FIRST EXCITED ^{111}Cd NUCLEUS.
H.Narumi and S.Matsuo.
Nuovo Cimento, Vol. 6, No. 2, 398-9 (Aug., 1957).

It is suggested that the attenuation of the $\gamma-\gamma$ angular correlation in In^{111}, incorporated in a face centred cubic crystal (Abstr. 3109/1956), is too great to be accounted for by interaction of the electric 16-pole moment but may arise from an electric quadrupole interaction induced by lattice phonons. M.A.Grace

539.152.2

9825. SPIN OF 27 HOUR ARSENIC 76. R.L.Christensen, H.G.Bennewitz, D.R.Hamilton, J.B.Reynolds and H.H.Stroke.
Phys. Rev., Vol. 107, No. 2, 633-4 (July 15, 1957).

Using a microwave discharge partly to dissociate As_4 vapour into atoms and atomic beam techniques, resonances were observed at 0.75, 1.48, and 5.6 Mc/s for the 27 hour isotope of As. A spin of 2 was thus assigned to the nucleus. R.W.Nicholls

539.152.2

9826. QUADRUPOLE MOMENT OF O^{17}.
M.J.Stevenson and C.H.Townes.
Phys. Rev., Vol. 107, No. 2, 635-7 (July 15, 1957).

The hyperfine structure of the $2_{2,0}-2_{2,1}$ rotational transition of HDO^{17} at 10374.31 Mc/s is resolved and the interpretation leads to a quadrupole coupling, $eq_aQ = -8.13 \pm 0.1$ Mc/s with asymmetry $\eta = 0.7 \pm 0.1$ and a magnetic interaction constant $a = -15 \pm 10$ kc/s. Assuming 40% ionic character for the OH bonds eq_a is computed to be 2.10×10^{6} e.s.u./cm^2 leading to $Q = (-0.026 \pm 0.009) \times 10^{-24}$ cm^2 for O^{17}. D.H.Whiffen

539.152.2

9827. NUCLEAR QUADRUPOLE MOMENT RATIO OF Re^{185} AND Re^{187}. S.L.Segel and R.G.Barnes.
Phys. Rev., Vol. 107, No. 2, 638 (July 15, 1957).

The pure quadrupole resonances were detected in $Re_2(CO)_{10}$ and showed that the spin of each isotope is 5/2 and the quadrupole moment ratio $Q(Re^{185})/Q(Re^{187}) = 1.056 \pm 0.005$. D.H.Whiffen

539.152.2

9828. HYPERFINE STRUCTURE AND NUCLEAR ELECTRIC QUADRUPOLE MOMENT OF ^{17}O.
R.A.Kamper, K.R.Lea and C.D.Lustig.
Proc. Phys. Soc. B, Vol. 70, Pt 9, 897-9 (Sept., 1957).

The hyperfine structure of the paramagnetic resonance spectrum of free O^{17} atoms produced by a r.f. discharge was studied in an apparatus previously described (Abstr. 3448/1957). The nuclear electric quadrupole moment was found to be $Q = -0.0265 \pm 0.003$ barn and the mean value $\langle r^{-3} \rangle$ for the valence electrons = 3.10×10^{25} cm^{-3} with an error ±10%. D.J.Oliver

539.152.2

9829. THE NUCLEAR MOMENTS OF RADIOACTIVE Tl^{204}.
H.G.Bennewitz, W.Paul and P.Toschek.
Z. Naturforsch., Vol. 11a, No. 11, 956 (Nov., 1956). In German.

539.152.2

9830. NUCLEAR MAGNETIC RESONANCE OF HYDROGEN IN METALS. R.A.Oriani, E.McCliment and J.F.Youngblood.
J. chem. Phys., Vol. 27, No. 1, 330 (July, 1957).

Proton resonance shifts relative to H_2O were found to be -0.0095% in $VH_{0.66}$ and 0.0000% in $TaH_{0.33}$. The smallness of these shifts indicate electron spin pairing at the H atoms. D.H.Whiffen

539.152.2

9831. SPIN-ECHOES WITH ANY NUMBER OF PULSES.
T.Ghose, S.K.Ghosh and D.K.Roy.
Nuovo Cimento (Ser. 10), Vol. 5, No. 3, 751-3 (March, 1957).

States that the number of echoes formed with a system of n pulses in nuclear magnetic resonance is $(3^n - 2^n - 1)/4$ and explains how these arise. D.H.Whiffen

539.152.2

9832. LOW-FIELD NUCLEAR MAGNETIC RESONANCE SPECTROMETER. R.W.Mitchell and M.Eisner.
Rev. sci. Instrum., Vol. 28, No. 8, 624-8 (Aug., 1957).

A spectrometer has been constructed and its performance at 12 and 43 gauss is discussed. The magnetic field is obtained with an end-corrected solenoid powered by batteries. The best resolution obtained is 10 microgauss at 12 gauss and 20 microgauss at 43 gauss over a 30 cm^3 sample. A twin-T bridge and a synchronous detector are employed for the nuclear resonance detection. Some of the measurements for which this instrument is suited are described and the results of relaxation time measurements for ethanol—water mixtures are presented. A.

539.153.4

9833. ON THE THEORETICAL VALUE OF THE ENERGY OF THE GROUND STATE OF He I. P.Pluvinage.
J. Phys. Radium, Vol. 18, No. 7, 474-5 (July, 1957). In French.

The "exact" method described in Abstr. 1493 (1956), with 13 basis functions, gives $E = -2.903\,892\,15$ atomic units, which is unreasonably far below that obtained by Kinoshita (Abstr. 5574/1957), with a wave-function of similar type, using a variational method. Careful search has disclosed no numerical error to explain this, and it appears that some unforeseen effect may be responsible and that the accepted value of the ionization energy may need revision. J.Hawgood

539.153.4

9834. WAVE FUNCTIONS AND ENERGY LEVELS FOR Fe AS FOUND BY THE UNRESTRICTED HARTREE—FOCK METHOD.
J.H.Wood and G.W.Pratt, Jr.
Phys. Rev., Vol. 107, No. 4, 995-1001 (Aug. 15, 1957).

Results of a self-consistent field calculation using Slater's average exchange potential are given for atomic iron. The usual restriction of doubly filled orbitals in closed shells is dropped and orbitals, with the same n and l quantum numbers but different m_s are varied separately. This results in a separate set of radial wave-functions for the two one-electron spin directions. The differences in these functions arise from an exchange polarization effect produced by the net spin of the Fe atom. Wave-functions, one-electron energy parameters, net spin charge density, and electrostatic potential functions for each spin are given. A comparison is made between these results and those obtained by the Hartree method. The magnetic form factor found with these new Fe orbitals is shown to be in good agreement with experiment. The fine-structure splittings are also evaluated and found not to be in as good agreement as those calculated by the Hartree method. The hyperfine splitting of the Mn^{++} ion is estimated using the new orbitals and found to be in much better agreement than estimates based on a limited configuration interaction. A.

539.153.4

9835. HYPERFINE STRUCTURE OF PARAMAGNETIC IONS.
V.Heine.
Phys. Rev., Vol. 107, No. 4, 1002-3 (Aug. 15, 1957).

The hyperfine structure of several paramagnetic ions and atoms such as Mn^{++} is known to contain an unexpected and large contribution due to some admixture of unpaired s electrons in the wave-function. An explanation of this is proposed in terms of the effect of exchange with the 3d electrons on the 2s and 3s electrons. Since the spins of the 3d electrons are at least partially lined up, exchange affects 2s, 3s electrons with parallel and antiparallel spin differently, so that the $2s^2\,3s^2$ electrons are not exactly paired. A rough preliminary calculation gives sufficiently good agreement with experiment to suggest that the proposed mechanism is an important factor, if not the complete explanation. Some detailed differences between various ions remain puzzling. A.

539.153.4

9836. α^3 CORRECTIONS TO THE HYPERFINE STRUCTURE OF THE 1S AND 2S STATES OF HYDROGEN. M.H.Mittleman.
Phys. Rev., Vol. 107, No. 4, 1170-80 (Aug. 15, 1957).

Recent precision measurements of the hyperfine splitting in the 1S and 2S states in hydrogen would make possible the observation of α^3 corrections. A calculation of these corrections would be difficult because of the many processes that can contribute to this order and because of the uncertainty of the nuclear structure effects that can contribute in this numerical order. For these reasons only the ratio of the hyperfine structure in the 2S state to that in the 1S state is calculated here. It is shown that the formation of the ratio eliminates the contribution of most of the α^3 corrections and totally eliminates the nuclear structure effects. The coefficient, B-A, of the α^3 terms in the ratio is calculated as (B-A) = 5.28. This compares with the experimental value, $(B-A)_{exp} = 3.4 \pm 0.8$. A.

539.153.4 : 535.338.332

THE QUADRUPOLE INTERACTION CONSTANTS FOR THE U^{233} ISOTOPE. See Abstr. 9606

539.154 : 53.081

9837. A SURVEY OF ATOMIC CONSTANTS.
J.A.Bearden and J.S.Thomsen.
Nuovo Cimento Suppl. (Ser. 10), Vol. 5, No. 2, 267-360 (1957).

An exhaustive survey of the data available in August 1955, with thorough descriptions and evaluations of all principal experiments and their theoretical interpretation. A re-evaluation of probable errors in individual experiments leads to a systematic selection of data for input to a least-squares analysis. The resulting recommended values for the constants do not differ significantly from those given by Cohen, DuMond et al. (Abstr. 2330/1956). The recommended value for the conversion factor for X-ray units, is now within half the probable error of the generally accepted value 1.002 02, going even further than Cohen et al. in removing the discrepancy between this accepted value and the result of their 1953 evaluation (Abstr. 1583/1954). There is still significant difference between the electrochemical value and those otherwise derived for the faraday. There are appendices on experiments since 1955, and on the theory of least squares, and 222 refs. J.Hawgood

539.155.1

9838. THE MASS OF He^3 ISOTOPE.
R.A.Demirkhanov, T.I.Gutkin and V.V.Dorokhov.
Atomnaya Energiya, Vol. 2, No. 5, 469-470 (1957). In Russian.

By a mass-spectrographic comparison with H^3 and HD, the He^3 mass has been found to be 3.016970 ± 2 atomic mass units, in good agreement with results based on nuclear reactions. L.Bovey

539.155.1

9839. THE MASSES OF THE ISOTOPES C^{13}, N^{14} AND N^{15}.
R.A.Demirkhanov, T.I.Gutkin and V.V.Dorokhov.
Atomnaya Energiya, Vol. 2, No. 6, 544-51 (1957). In Russian.

New measurements of the C^{13}, N^{14} and N^{15} isotope masses are reported. Internal consistency is shown by the mass values derived from different doublet systems. The measurements were carried out under conditions which excluded systematic error. A precise method to adjust the ion-focusing system is described. The values are found to be $13.007491 \pm (3 \times 10^{-6})$, $14.007527 \pm (4 \times 10^{-6})$ and $15.004890 \pm (5 \times 10^{-6})$ mass units for C^{13}, N^{14} and N^{15} respectively and these are in good agreement with those published previously by Nier and his collaborators (Abstr. 5336/1956). These results are higher than the average values obtained from nuclear reactions. The discrepancy is explained by inaccuracies in the Q-values used in the mass calculation of the original isotopes n_0, H, D, He^4 and C^{12} and the isotopes C^{13}, N^{14} and N^{15}. Tables giving detailed comparison with the results of workers on these isotopes are included.

L.Bovey

539.155.2

9840. NEW WAYS IN ISOTOPIC ANALYSIS OF URANIUM.
J.E.Lovett and J.O.Roberts.
Nucleonics, Vol. 15, No. 7, 72-5 (July, 1957).

Mass-spectrometer analysis is accurate but expensive; alternative methods include emission spectrography, neutron activation, reactor perturbation measurements and α and γ counting. Emission spectrography is the most suitable of the destructive testing methods, though it is difficult in the presence of U^{236}. For non-destructive testing of fuel elements etc. perturbation measurements in a low-power reactor appear most suitable. R.D.Smith

RADIOACTIVITY. α-, β- AND γ-RAYS 539.16

539.163.2

9841. RESOLVING COMPLEX DECAY CURVES. D.H.Perkel.
Nucleonics, Vol. 15, No. 6, 103-6 (June, 1957).

An analytical method of analysis applicable to two- or three-component curves. Accurate values of half-lives are required but only a few points on the decay curve need be measured. R.D.Smith

539.163.2

9842. DECAY OF ZINC-62.
E.Brun, W.E.Meyerhof, J.J.Kraushaar and D.J.Horen.
Phys. Rev., Vol. 107, No. 5, 1324-33 (Sept. 1, 1957).

The excited levels of Cu^{62} were investigated by studying the radiations from the decay of Zn^{62} with scintillation spectrometers. Gamma-rays of 0.042, 0.25, 0.26, 0.40, 0.51, and 0.59 MeV energy were resolved and are fitted into a consistent scheme of levels at 0.042, 0.30, 0.55, 0.63, and 0.70 MeV in Cu^{62}. Some information on the spins of these levels was obtained by gamma–gamma directional correlation measurements. Information on some gamma-rays from the decay of Cu^{62} was also obtained. A.

539.163.2

9843. DECAY SCHEME OF Co^{62}. D.G.Gardner and W.W.Meinke.
Phys. Rev., Vol. 107, No. 6, 1628-31 (Sept. 15, 1957).

A study of the decay of Co^{62} was made using β and γ scintillation techniques. The Co^{62} was produced by a (d,α) reaction on nickel oxide enriched in Ni^{64}. A half-life of 13.91 min with a calculated standard deviation of ±0.05 min was measured. Two beta-groups of 0.88 ± 0.04 and 2.88 ± 0.03 MeV energy were found, with relative abundances of 25% and 75%, respectively. Both β-ray transitions appear to be allowed. Gamma rays of 1.17 ± 0.01, 1.47 ± 0.02, 1.74 ± 0.03, and 2.03 ± 0.03 MeV were measured, with relative percentages of 100% and 82% for each member of the 1.17 MeV doublet, and 18%, 18%, and 7% for the others, respectively. A much weaker γ-ray with an energy of ~ 2.5 ± 0.2 MeV and an intensity of less than 2% was also noted. A level scheme incorporating these data is presented. All energy errors are estimated standard deviations. A.

539.163.2

9844. DECAY OF Cr^{51}. S.Ofer and R.Wiener.
Phys. Rev., Vol. 107, No. 6, 1639-41 (Sept. 15, 1957).

The spectrum of γ-rays from Cr^{51} was examined, including the spectrum in coincidence with the strong 325 keV γ-ray. The shape and intensity of the internal bremsstrahlung spectrum accompanying the K-capture transition to the ground state was found to be in fair agreement with theory as also was, within the experimental error, the intensity of the internal bremsstrahlung accompanying the K-capture decay to the 325 keV level. Two very weak γ-transitions of energies 320 keV and 645 keV and of intensities 10^{-5} and 5×10^{-6} per disintegration, respectively, were found, the former in cascade with the main 325 keV transition. A.

539.164.08

9845. LARGE-SENSITIVE-AREA PORTABLE ALPHA MONITOR.
F.D.Ryder and H.V.Hardison.
Nucleonics, Vol. 15, No. 7, 82 (July, 1957).

A 24 in^2 ZnS:Ag screen is viewed by a 5 in. photomultiplier supplied from a transistor high-voltage source. Greater sensitivity than that of previous survey instruments is claimed, together with greater stability, reliability and freedom from drift. R.D.Smith

539.164.08 : 537.542

ALPHA-SCINTILLATION MONITOR FOR HANDS AND CLOTHING. See Abstr. 9734

539.165 : 539.166

9846. ANGULAR CORRELATION OF RADIATIONS WITH PARALLEL ANGULAR MOMENTA. U.Fano.
Nuovo Cimento (Ser. 10), Vol. 5, No. 5, 1358-60 (May, 1957).

Angular correlations for a $\beta-\gamma-\gamma$ process are derived for the special case of all the angular momenta parallel. L.L.Green

539.16

9847. DIRECTIONAL CORRELATIONS OF β-RAYS. I.Hauser.
Nuovo Cimento Suppl. (Ser. 10), Vol. 5, No. 1, 182-221 (1957).

Explicit formulae for the directional correlation between β-particles and any succeeding nuclear radiation are derived and discussed. L.L.Green

539.165 : 530.145

9848. ON THE LONGITUDINAL POLARIZATION OF β PARTICLES.
P.E.Cavanagh, J.F.Turner, C.F.Coleman, G.A.Gard and B.W.Ridley.
Phil. Mag. (Eighth Ser.), Vol. 2, 1105-12 (Sept., 1957).

The longitudinal polarization of negative β-particles from unaligned sources was measured for particles of velocity 0.6 c selected from a thin Co^{60} source by a thin lens spectrometer. These particles entered crossed magnetic and electric fields, chosen to turn the polarization vector through 90° C, and the resulting transverse polarization was observed through the asymmetry in Coulomb scattering at 90° polar angle off a thin gold foil. Measurements were made as a function of azimuthal scattering angle and foil thickness, and were corrected for instrumental asymmetries. The zero-thickness asymmetry corrected for depolarization in the source, was (17.3 ± 3.5)% which combined with Sherman's (Abstr. 457/1957) calculations gives the polarization as (65 ± 13)%, initial spins being preferentially backward. These and other results agree well with a two-component theory with small axial vector interaction.
D.R.Chick

539.165 : 530.145

9849. FURTHER EXPERIMENTS ON β-DECAY OF POLARIZED NUCLEI.
E.Ambler, R.W.Hayward, D.D.Hoppes, R.P.Hudson and C.S.Wu.
Phys. Rev., Vol. 106, No. 6, 1361-3 (June 15, 1957).

Experiments, analogous to those previously performed with the β-emitter Co^{60}, have been carried out with polarized Co^{58} nuclei which emit positrons. An asymmetry was observed in the angular distribution of the positrons with a coefficient β of opposite sign and roughly one third of that for Co^{60}. In terms of the two-component theory of the neutrino, one will say that electron emission is associated with a left-handed antineutrino, whereas in positron decay a right-handed neutrino is emitted. A quantitative interpretation is complicated by the existence of parity conserving and parity non-conserving terms in the predominant Gamow—Teller interaction, and of an admixture of a Fermi interaction. In principle, from the momentum dependence of β one could determine whether invariance under time reversal is also violated, besides invariance under space reversal and under charge conjugation, but uncertainties due to the back-scattering and multiple-scattering corrections prevent definite conclusions being reached; more detailed measurements on Co^{60} show a fairly good linear dependence of β on v/c in the range 0.4-0.75. An experiment was also performed with Bi^{210} in order to set an upper limit to spurious effects: with this diamagnetic ion no beta asymmetry was observed to an accuracy of 0.5%.
L.Pincherle

539.165 : 539.166.835

9850. POSITRON POLARIZATION DEMONSTRATED BY ANNIHILATION IN MAGNETIZED IRON. S.S Hanna and R.S.Preston.
Phys. Rev., Vol. 106, No. 6, 1363-4 (June 15, 1957).

Positrons from a Cu^{64} source impinged on a cylinder of magnetized iron and the two-quanta yield was detected with two NaI counters on opposite sides and operated in coincidence. The coincidence rate was higher by about 5% with the saturation field parallel to the direction of motion of the positrons than with the field reversed. The geometry was such that the quanta observed corresponded to annihilation by electrons of high momentum. A plausible explanation is that the positrons emitted by the unpolarized source (spin change 1 → 0) are partially polarized parallel to their direction of motion, that annihilation takes place predominantly in the region of the iron crystal where the d-electrons have higher momentum than the s-electrons, and thus when the field is parallel to the positron spin, two-quanta annihilation is enhanced in the high-momentum region of the angular correlation. L.Pincherle

539.165

9851. CIRCULAR POLARIZATION OF INNER BREMSSTRAHLUNG.
G.W.Ford.
Phys. Rev., Vol. 107, No. 1, 321-2 (July 1, 1957).

It is pointed out that, by measuring the circular polarization of the inner bremsstrahlung photons accompanying β-decay, one can gain the same information as by measuring the longitudinal polarization of the electrons. Although at the source the bremsstrahlung intensity is much lower than the electron intensity, the intensities are comparable at their respective detectors. With the photon detector one could also measure simultaneously the polarization at several values of the energy. L.Pincherle

539.165 : 539.166.84

9852. CIRCULAR POLARIZATION OF INTERNAL BREMSSTRAHLUNG. R.E.Cutkosky.
Phys. Rev., Vol. 107, No. 1, 330-1 (July 1, 1957).

The internal bremsstrahlung associated with K-capture is examined theoretically for properties which are consequences of non-conservation of parity. It is envisaged as arising from the emission of a virtual positron which annihilates one of the K-electrons. Since β-particles are circularly polarized, the annihilation γ-rays are also polarized. By methods previously used by the author (Abstr. 10451/1954) it is found that the polarization of the γ-ray is the same of that of a zero-mass positron, independently of the nature of the β-interaction. The general results for the polarization of the internal bremsstrahlung accompanying β-emission are complicated: qualitatively, energetic γ-rays are right (left) circularly polarized if they accompany slow positrons (electrons), while low-energy γ-rays have a linear polarization correlated with the direction of the β-particle. L.Pincherle

539.165 : 530.145

9853. PARITY AND ELECTRON POLARIZATION: MØLLER SCATTERING. H.Frauenfelder, A.O.Hanson, N.Levine, A.Rossi and G.DePasquali.
Phys. Rev., Vol. 107, No. 2, 643 (July 15, 1957).

The experiments described in a previous paper (Abstr. 6504/1957) employed Mott scattering. The experiments here described employ Møller scattering, and are free from certain defects and limitations inherent in the previous method. P.M.Davidson

539.165

9854. ALLOWED CAPTURE—POSITRON BRANCHING RATIOS.
P.F.Zweifel.
Phys. Rev., Vol. 107, No. 1, 329-30 (July 1, 1957).

A correction to and extension of the tables of Abstr. 2142 (1955).
A.O.Stanesby

539.165

9855. BETA SPECTRUM OF Th^{233}. B.J.Dropesky and L.M.Langer.
Phys. Rev., Vol. 108, No. 1, 90-1 (Oct. 1, 1957).

The spectrum was measured in a ring-focus solenoidal spectrometer and was not found to exhibit an anomalous shape, as had been previously reported. The end-point is 1.23 ± 0.01 MeV in agreement with the earlier value. It is shown that Th^{233} decays predominantly to the ground state of Pa^{233}. Half-life measurements yield a value of (22.4 ± 0.1) min for Th^{233}, somewhat shorter than the previously reported values. A.

539.165.2

9856. ELECTRON—NEUTRINO ANGULAR CORRELATION IN THE POSITRON DECAY OF ARGON 35.
W.B.Hermannsfeldt, D.R.Maxson, P.Stahelin and J.S.Allen.
Phys. Rev., Vol. 107, No. 2, 641-3 (July 15, 1957).

The angular correlation coefficient λ was found from the spectrum of Cl^{35} recoils to be +0.70 ± 0.17. Since the decay occurs mainly through the Fermi matrix element, this value shows that the vector interaction is dominant. M.A.Grace

539.166.08

9857. SIMPLE RECORDING GAMMA-RAY SPECTROMETER.
W.H.Venable, Jr.
Nucleonics, Vol. 15, No. 7, 84-6 (July, 1957).

The bias level of a single-channel differential analyser is varied by an electric clock motor, and the output ratemeter voltage displayed against pulse height on a cathode-ray tube. A photographic record of the spectrum can then be made. R.D.Smith

539.166.08 : 537.533.08

A SPECTROMETER FOR HIGH-ENERGY PHOTONS. See Abstr. 9714

539.166.7

9858. GAMMA-RAY STREAMING THROUGH A DUCT.
D.G.Chappell.
Nucleonics, Vol. 15, No. 7, 65 (July, 1957).

A nomogram for rapid determination of the geometrical attenuation of the flux streaming through a duct from an emitting surface on which the duct abuts perpendicularly. R.D.Smith

539.166.83

9859. INTERNAL CONVERSION COEFFICIENTS FOR PURE E2 AND MIXED E2 + M1 TRANSITIONS.
F.K.McGowan and P.H.Stelson.
Phys. Rev., Vol. 107, No. 6, 1674-80 (Sept. 15, 1957).

K-shell internal conversion coefficients were measured for a number of pure E2 and mixed E2 + M1 transitions resulting from

the decay of low-lying rotational states. These states were produced either by Coulomb excitation or by radioactive decay. The experimental values for α_2^K are appreciably larger than the calculated values of Sliv and co-workers. A.

539.166.83

9860. INTERNAL CONVERSION COEFFICIENT OF γ-RADIATION OF 53 keV ENERGY IN THE L-SHELL OF Th^{230}.
A.A.Vorob'ev, V.A.Korolev, A.P.Komar and D.M.Seliverstov.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 623 (1957). In Russian.

Measured by $\alpha-\gamma$ coincidences from U^{234}, and found to be 130 ± 65 which suggests an electric quadrupole transition. W.O.Lock

539.166.835 : 537.533.8

9861. ELECTRON–PHOTON CASCADES OF HIGH ENERGY IN PHOTOGRAPHIC EMULSIONS. H.Fay.
Nuovo Cimento (Ser. 10), Vol. 5, No. 1, 293-8 (Jan., 1957).

Observations on eight electron–photon cascades indicate that the numbers and energy spectra of the particles as a function of shower depth, and the probability of trident production, are in agreement with quantum-electrodynamical theory. J.W.G.Wignall

NUCLEAR REACTIONS 539.17

539.172

9862. A FIRST LOOK AT FUSION-REACTOR CONTROL.
M.A.Schultz.
Nucleonics, Vol. 15, No. 6, 76-9 (June, 1957).

The kinetic performance of a fusion reactor is calculated from the kinetic equations describing a hypothetical system. The transfer function is derived and shows that a reactor based on the D–T reaction operating at a temperature of 100 keV, where the temperature coefficient is negative, would be stable and would behave like a fission reactor. At this temperature a reactor based on the D–D reaction would be unstable. R.D.Smith

539.172

9863. MULTIPLE EMISSION IN NUCLEAR REACTIONS.
A.Tomasini.
Nuovo Cimento, Vol. 6, No. 2, 404-7 (Aug., 1957).

A statistical theory is given which allows for the simultaneous emission of particles which may occur at high excitation energies of an excited nucleus. A greater probability of neutron emission and a larger N_α/N_p ratio is obtained compared with the predictions of the usual Weisskopf formula. Tables of results are given. W.O.Lock

539.172

9864. ANALYSIS OF RESULTS OF HIGH-ENERGY NUCLEAR REACTIONS. N.T.Porile and N.Sugarman.
Phys. Rev., Vol. 107, No. 5, 1422-30 (Sept. 1, 1957).

The determination of branching ratios for the formation of specific products at given deposition energies is described for high-energy nuclear ractions. These branching ratios may be obtained by use of deposition energy spectra from recent Monte Carlo calculations. The calculated branching ratios are used to analyze formation cross-sections in the BeV region into "fission" and "fragmentation" components, and to calculate average and most probable deposition energies for the formation of specific nuclides. The fission process in bismuth is compared with that in tantalum as to relative fissionability, deposition energy for fission, and spread in fissioning nuclei. A.

539.172

9865. ENERGY DEPENDENCE OF REACTIONS AT THRESHOLDS. G.Breit.
Phys. Rev., Vol. 107, No. 6, 1612-15 (Sept. 15, 1957).

As a development of Wigner's work on the subject, the behaviour of nuclear reactions at thresholds is discussed by employing the R-matrix formalism with special attention to the effect of a nuclear reaction threshold in a particular channel on the energy dependence in other channels. In addition to the characteristic cusp-like behaviour for $L = 0$, $Z_1Z_2 = 0$ it is found that for this case it is also possible to have another type of plot of cross-section v. energy. The second type differs from the first by a relative change of sign of the extra effect on one side of the threshold. A.

539.172

9866. NUCLEAR INTERACTION OF ENERGY 8×10^{13} eV IN A PHOTOGRAPHIC EMULSION.
I.M.Gramenitskiĭ, G.B.Zhdanov, E.A.Zamchalova and M.N.Shcherbakova.
Zh. éksper. teor. Fiz., Vol. 32, No. 4, 936-8 (1957). In Russian.

The analysis of an event of type $1 + 37\alpha$ is described; the angular distribution of the secondary particles agrees well with Landau's theory. W.O.Lock

539.172

NUCLEAR REACTIONS DUE TO COSMIC RAYS. See also under "Cosmic rays". Decimal classification 537.591.8

539.172

9867. CROSS SECTIONS OF NUCLEI FOR HIGH-ENERGY PIONS.
J.W.Cronin, R.Cool and A.Abashian.
Phys. Rev., Vol. 107, No. 4, 1121-30 (Aug. 15, 1957).

Measurements of the diffraction and absorption cross-sections of nuclei for negative pions at kinetic energies between 0.6 and 1.4 BeV are described. They include the absorption cross-section (1) in selected nuclei from Be to Pb at 0.97 BeV, (2) in C between 0.6 and 1.2 BeV, and (3) in Al, Ca, and Pb for 1.5 BeV/c momentum π^- and protons. Diffraction cross-sections were obtained for (1) Be, C, Al, and Ca at 0.97 BeV and (2) C at 0.6, 0.8, and 1.2 BeV. The data are compared to the optical model of the nucleus. Detailed computations are described both for a tapered Fermi-type distribution of nucleons which fits the high-energy electron scattering data and for a uniform square-well nucleon distribution of the form $R = r_0A^{1/3}$. All of the absorption cross-sections are shown to be in excellent agreement for a Fermi distribution with a single radial parameter $c = (1.14 \pm 0.04)A^{1/3} \times 10^{-13}$ cm, which is 6% larger that that required by electromagnetic measurements. The data are also consistent with the same value of the radial parameter as that which fits the electron-scattering data if the range of the pion–nucleon force is taken to be $\cong 1.0 \times 10^{-13}$ cm. This range is equal to the range required by pion–nucleon scattering data. A uniform distribution $R = r_0A^{1/3}$ is not consistent with the data. The diffraction cross-sections appear to be 20-30% higher than those predicted by the optical model and the dispersion relations. The implications of this discrepancy are discussed. A.

539.172 : 539.18

NUCLEAR REACTIONS DUE TO π-MESONS. See Abstr. 9406

539.172.13

9868. ELASTIC SCATTERING OF 5.7 MeV PROTONS.
M.Takeda, M.Kondo, R.Nakasima, C.Hu, A.Toi, T.Yamazaki and S.Yamabe.
J. Phys. Soc. Japan, Vol. 12, No. 8, 979-80 (Aug., 1957).

Differential cross-sections for elastic scattering of 5.7 MeV protons by iron, chromium and titanium were measured using nuclear emulsions. The ratio of observed to Rutherford cross-sections increases at large angles in all cases. D.R.Chick

539.172.13

9869. NUCLEON–SURFACE INTERACTION AND THE (p,n) REACTIONS. J.Sawicki and Z.Szymanski.
Nuovo Cimento (Ser. 10), Vol. 5, No. 6, 1777-81 (June, 1957).

The effect of nucleon–surface interaction on the cross-sections and angular distributions of (p,n) reactions is calculated using weak-coupling approximation. The results are applied to this Si^{29} (p,n) P^{29} reaction. L.L.Green

539.172.13

9870. THE ELASTIC AND INELASTIC SCATTERING OF POLARIZED PROTONS BY CARBON. J.M.Dickson and D.C.Salter.
Nuovo Cimento, Vol. 6, No. 1, 235-41 (July, 1957).

Measurements were made of the cross-section and asymmetry for elastic scattering and for inelastic scattering from the 4.43 MeV and 9.61 MeV levels of carbon at proton energies of 135 and 95 MeV. The energy resolution of the polarized beam was improved by selecting protons in a 20 μsec interval of the 250 μsec beam pulse. The 9.61 MeV inelastic polarization shows no significant difference from that for the 4.43 MeV level, but there is a considerable difference between the 135 and 95 MeV values for these two levels. E.J.Burge

539.172.1

9871. CHARACTERISTICS OF NUCLEAR DISINTEGRATIONS PRODUCED BY PROTONS OF 140 ± 6 MeV.
S.Jannelli and F.Mezzanares.
Nuovo Cimento Suppl. (Ser. 10), Vol. 4, No. 2, 939-49 (1956). In Italian.

Ilford G5 emulsions (600μ thick) exposed to a proton beam of

(140 ± 6) MeV were subjected to area scanning. The length of proton track scanned was thus effectively 26 810 ± 1340 cm and 652 stars were found. To eliminate coulomb effects one-prong stars not showing a change of ionization were rejected if the angle was $< 20^0$. The ratio of particles in the forward and backward hemispheres was investigated for various categories of events and the results are in accord with those reported by other workers. Stars in light and heavy nuclei were separated and values of (952 ± 124) mb and (160.5 ± 26) mb respectively found for the interaction cross-sections. K.H.Barker

539.172.13

9872. CHARACTERISTICS OF NUCLEAR DISINTEGRATIONS PRODUCED BY PROTONS OF 140 ± 6 MeV. II. HEAVY NUCLEI. S.Jannelli and F.Mezzanares.
Nuovo Cimento (Ser. 10), Vol. 5, No. 2, 380-92 (Feb., 1957). In Italian.

The nuclear disintegrations produced in the heavy elements of Ilford G5 600 μ emulsions by 140 MeV protons were studied and 634 stars examined. The results of the analysis are in agreement with the conclusions reached by other workers about the possibility of describing the production of stars according to the well known model of nuclear cascade followed by a nuclear evaporation. The existence of low energy protons emitted sometimes from the nuclei in the de-excitation process, following the evaporation, is confirmed. The best values of some parameters which are relevant in the process of production of stars are deduced. A.

539.172.13

9873. CHARACTERISTICS OF NUCLEAR DISINTEGRATIONS PRODUCED BY PROTONS OF 140 ± 6 MeV. III. LIGHT NUCLEI. S.Jannelli and F.Mezzanares.
Nuovo Cimento (Ser. 10), Vol. 5, No. 5, 1047-56 (May, 1957). In Italian.

The nuclear disintegrations produced in the light elements (C, N, O) of Ilford G5 600 μ emulsions by 140 MeV protons were studied and 220 stars (of which 108 found by systematic scanning) were examined. The most reliable values of some characteristic parameters, in the process of disintegration, resulting from the data of the present work and from those of others, are given. The disintegrations produced in the various elements are recognized: these are in accordance with the α-particle model of light nuclei and with the proposed schemes. Such schemes give an explanation for about 45% of the disintegrations, in the remaining cases there is the emission of some particles (by local evaporation, e.g.) and of a fragment ($Z \geq 3$). It seems that the frequency of the disintegrations in the various elements depends essentially on their abundance in the emulsion. A.

539.172.13 : 539.18

9874. S-WAVE PIONS IN THE REACTION $p + p \rightarrow \pi^+ + d$. F.S.Crawford,Jr and M.L.Stevenson.
Phys. Rev., Vol. 107, No. 1, 331-2 (July 1, 1957).

Re-analysis of the authors' results for the $p + p \rightarrow \pi^+ + d$ differential cross-section in terms of a more refined phenomenological model (Lichtenberg, Abstr. 4775/1957) indicates that the s-wave, although reduced in relative amplitude, remains non-zero near the threshold. R.H.W.Johnston

539.172.13

9875. ELASTIC SCATTERING OF 7.5-MeV PROTONS. W.F.Waldorf and N.S.Wall.
Phys. Rev., Vol. 107, No. 6, 1602-8 (Sept. 15, 1957).

Angular distributions were measured for protons elastically scattered from a series of elements with atomic numbers Z = 13 to Z = 49. The measurements were made, and the results are presented in terms of the ratio of the differential cross-section from a particular nucleus to that of the scattering from a point charge nucleus of the same total charge. The data are interpreted in terms of the scattering from a complex-potential well with the slight variations in nearby elements interpreted as arising from a compound-elastic contribution to the over-all elastic scattering. A.

539.174.13

9876. ANGULAR DISTRIBUTION OF PROTONS FROM THE $Ca^{40}(d,p)Ca^{41}$ REACTION. C.K.Bockelman and W.W.Buechner.
Phys. Rev., Vol. 107, No. 5, 1366-71 (Sept. 1, 1957).

Proton groups emitted from a thin CaO target under 7 MeV deuteron bombardment were studied with a magnetic spectrograph. Their angular distributions were analyzed in terms of stripping theory to determine the orbital angular momenta and relative reduced widths for neutrons captured to form levels in Ca^{41} up to 4.2 MeV excitation. Capture gamma-rays measured elsewhere can be fitted to a scheme comprised of levels strongly excited in the (d,p) reaction. Evidence is found for single-particle $f_{7/2}$, $p_{3/2}$, and $p_{1/2}$ states, but the expected $f_{5/2}$ level does not appear. Relative cross-sections and reduced widths for (d,p) reactions forming states in Ca^{43} and Ca^{45} are also tabulated. A.

539.172.13

9877. $T(d,n)He^4$ REACTION. S.J.Bame, Jr and J.E.Perry, Jr.
Phys. Rev., Vol. 107, No. 6, 1616-20 (Sept. 15, 1957).

The differential cross-sections for neutron production were measured over the deuteron bombarding-energy range 0.25 to 7.0 MeV. Legendre polynomial fits to the data are presented and compared with existing data. The total cross-section plotted as a function of deuteron energy has an anomalous behaviour which may indicate a broad level in He^5 near 20 MeV excitation energy. A.

539.172.13

9878. ANGULAR DISTRIBUTION OF THE $D(d,n)He^3$ REACTION BELOW 1 MeV. J.C.Fuller, W.E.Dance and D.C.Ralph.
Phys. Rev., Vol. 108, No. 1, 91-3 (Oct. 1, 1957).

Angular distributions of the $D(d,n)He^3$ reaction were measured at 9 deuteron energies ranging from 0.1 MeV to 0.9 MeV. Neutrons were detected by two plastic scintillators mounted on photomultiplier tubes, one of which could be rotated to make angles of 0^0 to 165^0 with the beam direction. The other scintillator, placed on the rotational axis, was used as a reference counter. Data were fitted to the expression $d\sigma(\theta') = d\sigma(90^0)(1 + A\cos^2\theta' + B\cos^4\theta')$ in the centre-of-mass system by the method of least squares. The asymmetry coefficients are compared with those obtained by other workers. A.

539.172.13

9879. ON THE DERIVATION OF THE FORMULA FOR THE FORMATION CROSS-SECTION OF HIGH-ENERGY NEUTRONS IN COLLISIONS OF DEUTERONS WITH NUCLEI. V.S.Anastasevich.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 626-7 (1957). In Russian.

Using a classical picture the total cross-section for neutron production in fast deuteron stripping is derived as $\frac{1}{2}\pi$ Rd, where R is the nuclear radius and d is the mean internucleon separation in the deuteron. J.W.G.Wignall

539.172.3

9880. NOTE ON THE TWO-STAGE MECHANISM OF THE (γ,d) REACTIONS. J.Sawicki and W.Czyż.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 5, No. 6, 631-8 (1957).

The ratio of the cross-sections for (γ,p) and (γ,d) reactions has been calculated together with the angular distribution of the deuterons assuming a two-stage mechanism for the deuteron reaction. The theory is applied to the $S^{32}(\gamma,d)P^{30}$ reaction. L.L.Green

539.172.3

9881. THE PHOTOPROTONS EMITTED FROM CARBON AND NITROGEN NUCLEI. D.L.Livesey.
Canad. J. Phys., Vol. 35, No. 9, 987-94 (Sept., 1957).

The photoprotons from carbon were studied by exposing propane gas to bremsstrahlung of maximum energy 35 MeV and recording the charged particles produced in photographic plates. The energy distribution displays a peak near 6.0 MeV which is related to the position of the dipole resonance in C^{12} nuclei. The angular distribution of protons near the peak energy agrees closely with a function $f(\theta) = A + B\sin^2\theta$, but at higher energies most of the protons are emitted at forward angles. Nitrogen gas was also bombarded with bremsstrahlung of maximum energies 30 and 70 MeV. The energy distributions of the photoprotons are interpreted in terms of known reactions in the N^{14} nucleus. A.

539.172.3

9882. C AND Al PHOTOPROTON ANGULAR AND ENERGY DISTRIBUTION. C.Milone, R.Ricamo and A.Rubbino.
Nuovo Cimento (Ser. 10), Vol. 5, No. 2, 528-31 (Feb., 1957).

These were measured using a 31 MeV bremsstrahlung beam and nuclear emulsions. For C the proton spectrum shows a maximum between 5 and 6 MeV: below 5.5 MeV the angular distribution is isotropic and above it a pronounced forward (60^0) peak is observed. For Al the maximum occurs at 5 MeV and the angular distribution which has a backward–forward symmetry shows an anisotropy which increases with photoproton energy. M.A.Grace

539.172.3

9883. CROSS SECTION FOR THE $Ca^{40}(\gamma,3p3n)Cl^{34}$ REACTION. F.D.Schupp, C.B.Colvin and D.S.Martin, Jr.
Phys. Rev., Vol. 107, No. 4, 1058-61 (Aug. 15, 1957).

The cross-section as a function of photon energy was determined up to 70 MeV. With a threshold for the process below 35 MeV

the cross-section function was found to have a resonance-shaped peak of 0.3 millibarn at 50 MeV with a width at half-height of 6 MeV. The integrated cross-section was 2.7 MeV mb. The mode of the process is discussed on the basis of a statistical model. A.

539.172.3

9884. PHOTODISINTEGRATION OF THE LIGHTEST NUCLEI. L.L.Foldy.
Phys. Rev., Vol. 107, No. 5, 1303-5 (Sept. 1, 1957).

It is shown that for nuclei in which the ground state wave-function is symmetric in the space coordinates of all the nucleons, such as H^2, H^3, He^3, He^4, the integrated bremstrahlung-weighted cross-section for electric dipole absorption, is simply related to the mean-square radius of the nucleus, independent of the existence of correlations between the motions of the nucleons. This relationship was first derived by Levinger and Bethe on the assumption of absence of correlation, and was found to be at variance with known experimental results in heavy nuclei. Experimentally, the relationship is well verified by data on H^2 and He^4. The relationship of the integrated bremsstrahlung-weighted cross-section to certain nuclear parameters in the case of Li^6 is briefly discussed. A.

539.172.3

9885. PHOTODISINTEGRATION OF THE NEON NUCLEUS. A.P.Komar and I.P.Yavor.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 614-15 (1957). In Russian.

A natural mixture of neon isotopes in a fast-operating Wilson cloud chamber is irradiated with γ-rays of maximum energy 80 MeV. The angular distribution of photoprotons of energy 1-15 MeV is measured, and found equal to $a + b\sin^2\theta$ where $b/a \cong 2.5$.

G.E.Brown

539.172.3 : 539.152.1

PHOTONUCLEAR REACTIONS AND THE GIANT RESONANCE. See Abstr. 9811

539.172.4

9886. FURTHER MEASUREMENTS ON n,p REACTIONS AT 14 MeV. II. SULPHUR, ALUMINIUM, IRON, COPPER, NICKEL. L.Colli and U.Facchini.
Nuovo Cimento (Ser. 10), Vol. 5, No. 1, 309-14 (Jan., 1957).

The measurements given were made in the same manner as those of the previous papers (Abstr. 723, 4737/1957). The results of these and of the present paper are combined to give the relative total cross-section for the production of protons with $E > 3$ MeV and lying within a forward angle of 60°, as follows:

Mg	Al	Si	S	Ca	Fe	Ni	Cu	Zn	Zr
0.88	0.83	1.79	2.61	4.03	0.97	3.10	1	1.14	0.60

J.H.Fremlin

539.172.4

9887. COMPARISON BETWEEN THE PROTON ENERGY SPECTRA OF (n,p) AND (d,p) REACTIONS. J.Blok and C.C.Jonker.
Nuovo Cimento, Vol. 6, No. 2, 378-9 (Aug., 1957).

Comparison of the published data suggests that the deviations in the proton energy spectra of (n,p) reactions have the same origin as the giant resonances in the (d,p) spectra, although the reaction mechanisms are different. W.O.Lock

539.172.4

9888. ANGULAR DISTRIBUTIONS OF SCATTERED NEUTRONS. A.Langsdorf, Jr, R.O.Lane and J.E.Monahan.
Phys. Rev., Vol. 107, No. 4, 1077-87 (Aug. 15, 1957).

The angular distribution of neutrons scattered from 36 elements and one compound was measured over the energy interval 60 keV to 1800 keV. The results are presented in terms of the coefficients of a Legendre-polynomial expansion of the differential scattering cross-section in the laboratory coordinate system. All of the data are corrected for attenuation of the primary beam and a representative part of the data is corrected for multiple scattering and for the finite angular resolution of the experimental equipment. The analytical details of the multiple (essentially, double) scattering corrections are given in an appendix. A.

539.172.4

9889. CROSS SECTIONS FOR PICKUP REACTIONS OF 14-MeV NEUTRONS WITH N^{14}. R.R.Carlson.
Phys. Rev., Vol. 107, No. 4, 1094-8 (Aug. 15, 1957).

The absolute differential cross-sections for the reactions $N^{14}(n,d)C^{13}$ and $N^{14}(n,d)C^{13*}$ (3.68 MeV) were measured with 14 MeV neutrons at seven laboratory angles from 0° to 65°. The deuterons were detected with a coincidence-telescope spectrometer consisting of two proportional counters and a thin CsI(Tl) scintillator. The angular distributions are both fitted with Butler-type curves for angular momentum transfers of one in agreement with positive parity and spin one for the ground state of N^{14}. The reduced width for the ground-state transition agrees with that for the reaction $N^{14}(p,d)N^{13}$ as required by charge symmetry of nuclear forces. The ratio of the reduced width for the ground-state transition to that for the excited-state transition rules out the possibility that the N^{14} ground state be a pure $^3D_1$ state. No yield was observed corresponding to the 3.09 MeV and 3.89 MeV states of C^{13}. A.

539.172.4

9890. CROSS SECTIONS FOR THE $S^{32}(n,p)P^{32}$ AND THE $S^{34}(n,\alpha)Si^{31}$ REACTIONS. L.Allen, Jr, W.A.Biggers, R.J.Prestwood and R.K.Smith.
Phys. Rev., Vol. 107, No. 5, 1363-6 (Sept. 1, 1957).

The cross-section for $S^{32}(n,p)P^{32}$ was measured for incident neutron energies up to 15 MeV. The data at high energies differ from previously published measurements. The cross-section for $S^{34}(n,\alpha)Si^{31}$ was measured for incident neutron energies up to 14.1 MeV. A.

539.172.4

9891. THE CUMULATIVE YIELDS OF THE KRYPTON AND XENON ISOTOPES PRODUCED IN THE FAST NEUTRON FISSION OF Th^{232}. T.J.Kennett and H.G.Thode.
Canad. J. Phys., Vol. 35, No. 8, 969-79 (Aug., 1957).

The relative fission yields for mass chains ending in stable krypton and xenon isotopes were measured for the fast-neutron-induced fission of Th^{232}. Isotope dilution techniques were used to determine the krypton/xenon ratio to assist in obtaining the absolute fission yields for these mass chains. The absolute yields were determined by the use of two methods, both giving results which were in excellent agreement. The fine structure observed for the Th^{232} mass–yield curve is compared with that of heavier fissile nuclides. A.

539.172.4 : 539.185

9892. HOW TO INTEGRATE THE U^{235} FISSION-NEUTRON SPECTRUM. F.T.Binford.
Nucleonics, Vol. 15, No. 2, 94-5 (Feb., 1957).

The number of fission neutrons having energies E in the range a to b $[N(a \to b) = \int_a^b Ae^{-E}\sinh\sqrt{2E}\,dE]$ can be evaluated by expressing the integral as a sum of hyperbolic and error functions. Then

$$N(0 \to x) = \tfrac{1}{4}[\mathrm{erf}(\sqrt{x} + 1/\sqrt{2}) + \mathrm{erf}(\sqrt{x} - 1/\sqrt{2})] - \sqrt{2/\pi}\, e^{-1/2}\, e^{-x}\sinh\sqrt{2x},$$

or, for large x,

$$N(0 \to x) \cong 1 - \sqrt{2/\pi}\, e^{-1/2}\, e^{-x}\sinh\sqrt{2x}$$

R.D.Smith

539.172.4

9893. PREDICTION OF DELAYED-NEUTRON PRECURSORS. G.R.Keepin.
Phys. Rev., Vol. 106, No. 6, 1359-60 (June 15, 1957).

The particular precursor nuclides which are to be hypothesized as responsible for delayed-neutron groups in the fission of six fissionable nuclides ($U^{233, 235, 238}$, $Pu^{239, 240}$ and Th^{232}) are selected on the basis of agreement between calculated precursor yields, experimental delayed-neutron yields, and theoretical n–β branching ratios. A.O.Stanesby

539.172.4

9894. SPONTANEOUS-FISSION HALF-LIVES OF Cf^{254} AND Cm^{250}. J.R.Huizenga and H.Diamond.
Phys. Rev., Vol. 107, No. 4, 1087-90 (Aug. 15, 1957).

Least-squares analysis of spontaneous-fission data obtained over the last four years from a californium sample produced in the November, 1952 thermonuclear test gives a Cf^{254} spontaneous-fission half-life of 56.2 ± 0.7 days in agreement with the astrophysical value of 55 ± 1 days. Some comments are made on the neutron buildup in Type I supernovae and the influence of a possible double magic number, N = 184, Z = 82, at A = 266 on the yield curve near A = 254. An approximate spontaneous-fission half-life of 2×10^4 years for Cm^{250} is deduced from a curium sample also produced in the November, 1952 thermonuclear test. A.

539.172.4 : 536.2

9895. TEMPERATURE TRANSIENTS IN GAS-COOLED THERMAL NUCLEAR REACTORS. J.H.Bowen and E.F.O.Masters.
Proc. Instn Elect. Engrs, Paper 2422M, publ. Oct., 1957, 13 pp. To be republished in Vol. 105A (1958).

Examines the transient behaviour of the Calder Hall type of reactor in terms of the design and operating parameters, the main

transients examined being those arising from: (a) Step changes in reactivity. (b) Steady changes in reactivity including the start-up condition. (c) Step changes in cooling. (d) Steady and other changes in cooling due to both circulator-speed and gas-pressure changes. The examination was carried out by means of an analogue computer and by a graphical method which employs an approximate solution of the neutron-kinetic equations. The results obtained by the two methods are compared and agreement is shown to be good. The graphical method was extended to take account of temperature gradients within the fuel elements and fission-product heating. Account is also taken in the computations of the heat generated in the graphite. The effects of non-uniformity in the axial and radial temperature distribution on the temperature transient throughout the reactor are examined and assessed. It is concluded that the graphical method is useful for studying the transient characteristics of a reactor, but, owing to the importance and complexity of the subject, experimental confirmation of the predicted results is desirable. A.

539.172.4

9896. ACTIVITY TRANSPORT IN SODIUM-COOLED SYSTEMS. F.G.Haag.
Nucleonics, Vol. 15, No. 2, 58-61 (Feb., 1957).

Measurements of the rate of transport of radioactive Co^{60}, Mn^{54}, Ta^{182}, Fe^{59} and Cr^{51} in liquid sodium flowing in stainless steel were made in order to estimate the activity build up in various parts of a sodium-cooled reactor system. The rate rises exponentially with temperature and increases rapidly with increasing oxide content. No dependence on coolant velocity or radiation was found. Twelve metals were tested as inhibitors and barium was found to be the most effective. R.D.Smith

539.172.4

9897. THE ENGINEERING TEST REACTOR.
Nucleonics, Vol. 15, No. 3, 41-56 (March, 1957).
TEST REACTORS — THE LARGER VIEW (42).
CORE AND FACILITIES.
R.H.Dempsey, J.J.Jacobson, S.Levy and B.Wolfe (44-7).
DESIGN AND CONSTRUCTION. P.D.Bush (48-56).

A report of the design, construction and facilities of the Engineering Test Reactor now under construction at the National Reactor Testing Station in Arco, Idaho. The reactor is rated at 175 MW, with peak neutron fluxes of 4×10^{14} thermal and 1.5×10^{15} fast. The core contains 15 kg of U^{235} in the form of flat-plate Al–U alloy MTR-type fuel assemblies. These contain boron as a burnable poison. The core is surrounded by $4\frac{1}{2}$ in. Be reflector, and is cooled by water at 200 lb/in^2 and 110° F contained in a carbon-steel, stainless-steel lined, pressure vessel. Details are given of the core characteristics and the mechanical design of the reactor.

R.D.Smith

539.172.4 : 539.185.08

9898. MEASURING FLUX ABSOLUTELY WITH INDIUM FOILS. M.A.Greenfield, R.L.Koontz, A.A.Jarrett and J.K.Taylor.
Nucleonics, Vol. 15, No. 3, 57-61 (March, 1957).

The thermal neutron flux in a reactor may be determined by absolute counting of irradiated indium foils using a 2π flow counter. Corrections due to window absorption, efficiency, gamma background, backscattering and self-absorption are considered. Graphs are given showing the corrections necessary for foils up to a thickness of 100 mg/cm^2 with and without a thick silver backing. The total error in estimating the specific activity is about 5%; the error in determining the neutron flux absolutely is increased by the uncertainty in the indium cross-section. R.D.Smith

539.172.4

9899. ARGONAUT — ARGONNE'S REACTOR FOR UNIVERSITY TRAINING. R.H.Armstrong and C.N.Kelber.
Nucleonics, Vol. 15, No. 3, 62-5 (March, 1957).

A 10 kW thermal heterogeneous water-cooled reactor with an annular core reflected internally and externally by graphite. The core loading is 3.7 kg U^{235} (20% enriched). The central graphite reflector may be removed, leaving a large space for experiments. The reactor is inherently safe. R.D.Smith

539.172.4 : 539.166.9

9900. GAMMA-RAY HEATING IN B.S.R. F.T.Binford.
Nucleonics, Vol. 15, No. 3, 93-7 (March, 1957).

The rates of heating due to gamma-ray absorption in Al, Pb, Fe, and Cu were measured near to the core of the Bulk Shielding Reactor (B.S.R.). R.D.Smith

539.172.4

9901. FAST BREEDER POWER REACTORS — THEIR PROBLEMS AND PROSPECTS.
Nucleonics, Vol. 15, No. 4, 62-6 (April, 1957).

In order to use the world resources of U^{238} for power generation it is essential to develop fast reactors. The variation of fission and capture cross-sections with energy show that fast reactors have a larger critical mass and require enriched fuel but lose fewer neutrons by absorption in structural materials than do thermal systems. If the average neutron energy is above 0.1 MeV, with a U^{238} blanket breeding ratios are 1.5 for a Pu^{239} core and 1.2 for a U^{235} core compared with less than unity for a thermal system. Difficulties arise due to the high core-power densities and the use of sodium as a coolant, the high processing costs and possible hazards of operation. The safety is affected by the short prompt-neutron lifetime, by the danger of accidental addition of a moderator, by possible positive temperature coefficients due to movements of fuel or Doppler effect and by the possible formation of a supercritical mass after an accidental meltdown of the core. R.D.Smith

539.172.4

9902. ENRICO FERMI REACTOR. DESIGN OF FIRST FAST BREEDER.
Nucleonics, Vol. 15, No. 4, 68-72 (April, 1957).

The Enrico Fermi fast breeder reactor generates 300 MW of heat and has a net output of 90 MW of electricity using sodium as a coolant. The core, 31.2 in. high and 30.5 in. dia., contains 485 kg U^{235}. The fuel elements consist of clusters of 144 Zr-clad pins containing 10% by weight of Mo–U alloy (27% enriched uranium). The reactor is controlled by the insertion of enriched boron absorbing rods into the core. Eight safety rods and two shim control rods are used. Maximum fuel temperature is 1300° F. The reactor is being built 30 miles SW of Detroit. R.D.Smith

539.172.4

9903. DIPHENYL AS A THERMODYNAMIC FLUID. D.C.Purdy.
Nucleonics, Vol. 15, No. 4, 109-12 (April, 1957).

Diphenyl is less reactive than water and has advantages as a coolant for nuclear reactors. Compared with steam as a working fluid in a turbine cycle it is found to have comparable efficiency if lower condenser pressures can be attained. A diphenyl–steam binary cycle has a higher efficiency and might be used in a reactor requiring an intermediate loop. R.D.Smith

539.172.4

9904. CALCULATING BURNOUT EFFECTS.
A.W.Banister and R.L.Murray.
Nucleonics, Vol. 15, No. 6, 129-33 (June, 1957).

An iterative solution of the critical diffusion equation describing a reactor after appreciable burnup is described and compared with the standard perturbation theory calculation. The new method is claimed to be simpler and more flexible. R.D.Smith

539.172.4 : 518.5

ANALOGUE AND DIGITAL COMPUTATION IN NUCLEAR ENGINEERING. See Abstr. 9489-93

539.172.4 : 537.533.9

STUDY OF THE LIGHT EMITTED IN THE MODERATOR OF A HEAVY-WATER ATOMIC PILE. See Abstr. 9725

ATOM AND MOLECULE BEAMS. MESONS. NEUTRONS 539.18

539.18

9905. ON THE THEORY OF STRANGE PARTICLES.
V.I.Karpman.
Zh. éksper. teor. Fiz., Vol. 32, No. 4, 939-40 (1957). In Russian.

If one tries to fit in the super-heavy meson ω^- found by Eisenberg (Abstr. 1225/1955) and others into the interpretation of d'Espagnat and Prentki of Gell-Mann's scheme, a strangeness $S = -2$ must be assigned if it is to be an isotopic singlet. G.E.Brown

539.18

9906. EXPERIMENTS WITH A POLARIZED MUON BEAM.
J.M.Cassels, T.W.O'Keeffe, M.Rigby, A.M.Wetherell and J.R.Wormald.
Proc. Phys. Soc. A, Vol. 70, Pt 7, 543-6 (July, 1957).

Investigates the time distribution of forward-emitted decay electrons from μ^+-mesons stopping in absorbers of copper, graphite and scintillator (polystyrene + 2% p-terphenyl) immersed in a

transverse magnetic field. From the observed modulation the g-value of the μ-meson is 2.004 ± 0.014. For scintillator the asymmetry coefficient is -0.06 ± 0.04 probably due to the formation of muonium; no evidence was found for oriented triplet muonium.
K.H.Barker

539.18

9907. AN ANALYSIS OF ROCHESTER $K_{\mu 3}$ AND K_{e3} DATA.
S.Furuichi, Y.Sugahara, A.Wakasa and M.Yonezawa.
Nuovo Cimento (Ser. 10), Vol. 5, No. 1, 285-8 (Jan., 1957).
On the basis of the authors' theory (Abstr. 6600/1957), the observed decay spectra for the $K_{\mu 3}$ and K_{e3} modes are discussed in terms of scalar or vector K-mesons and various types of four-fermion coupling. J.W.G.Wignall

539.18

9908. EMISSION OF AN ELECTRON PAIR IN A K^+-DECAY.
R.Levi-Setti and W.Slater.
Nuovo Cimento (Ser. 10), Vol. 5, No. 6, 1784-6 (June, 1957).
The decay at rest of a K^+ particle in an emulsion stack exposed to the 4.5 GeV π^- Bevatron beam is analysed. The observed emitted particles are a π^+ and two electrons. The kinematics of the decay suggest that two π^0-particles are emitted, one of which gives rise to the electron pair. J.W.Sturgess

539.18

9909. ON INTERFERENCE PHENOMENA IN THE DECAY OF STRANGE PARTICLES. V.B.Berestetsky.
Nuclear Physics, Vol. 3, No. 2, 157-60 (April, 1957).
The decay processes

$$\Xi^- \rightarrow \Lambda^0 + \pi_1^- \rightarrow p + \pi_1^- + \pi_2^-$$
$$\Sigma^0 \rightarrow \Lambda^0 + \gamma \rightarrow p + \pi^- + \gamma$$

are analysed along lines similar to those of Lee and Yang (Abstr. 2681/1957) for the decay of Λ and Σ particles into nucleons and π-mesons. J.S.Bell

539.18

9910. INFLUENCE OF STRONG MAGNETIC FIELD ON DEPOLARIZATION OF MUONS. J.Orear, G.Harris and E.Bierman.
Phys. Rev., Vol. 107, No. 1, 322-3 (July 1, 1957).
The directional asymmetry observed in the decay of polarized positive muons is reduced if the muons are depolarized by interatomic magnetic fields while waiting to decay. A photographic plate experiment has shown that the effect is much reduced if the atomic systems are caused to precess rapidly enough by a strong external magnetic field applied parallel (or antiparallel) to the muon spin axis. J.M.Cassels

539.18

9911. PROPOSED EXPERIMENT TO DETERMINE THE DIRECTION OF μ-MESON POLARIZATION IN PION DECAY.
J.D.Jackson, S.B.Treiman and H.W.Wyld,Jr.
Phys. Rev., Vol. 107, No. 1, 327-8 (July 1, 1957).
Polarized muons captured in carbon have a 13% chance of forming B^{12} which is β-active and would be partially polarized in the muon spin direction. An experimental search for directional asymmetry in the decay-electron distribution would be worth while. Possible depolarizing mechanisms, such as hyperfine interaction with the atomic electrons, are considered. R.H.W.Johnston

539.18

9912. RADIATIVE CORRECTIONS TO THE ASYMMETRY PARAMETER OF LOW-ENERGY POSITRONS IN MUON DECAY.
T.Kinoshita and A.Sirlin.
Phys. Rev., Vol. 107, No. 2, 638-9 (July 15, 1957).
These have been calculated assuming the two-component neutrino theory and have the effect of reducing the value of the asymmetry coefficient without however reversing its sign.
R.H.W.Johnston

539.18

9913. ON POSSIBLE CORRELATIONS IN $\pi-\mu-e$ DECAY.
L.Okun' and A.Rudik.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 627-8 (1957). In Russian.
Assuming parity violation in both $\pi-\mu$ and $\mu-e$ decays the angular correlation of muon and positron momenta is calculated.
J.W.G.Wignall

539.18

9914. STRONG INTERACTION OF K-PARTICLES WITH π-MESONS. S.G.Matinyan.
Zh. éksper. teor. Fiz., Vol. 32, No. 4, 930-1 (1957). In Russian.
It is assumed that the K—π interaction is strong and that the τ-meson first decays into a π and θ, the latter decaying into two π's. This gives a specific restriction on the ratio of the two possible τ-decays, when used in conjunction with other selection rules.
G.E.Brown

539.18 : 530.145

PARITY NON-CONSERVATION IN HYPERON DECAY. See Abstr. 9529

539.18

9915. ON THE LIFETIME OF TWO TYPES OF π^0-MESONS.
A.V.Romankevich.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 615 (1957). In Russian.
According to the hypothesis of Fermi and Yang (Abstr. 2686/1950) two types of π^0-meson exist: $\pi^0(p + \bar{p})$ and $\pi^0(n + \bar{n})$, where p = proton, n = neutron, $\bar{p}$ = antiproton and $\bar{n}$ = antineutron. An expression for the lifetimes of these mesons is given. S.Chomet

539.18

9916. ANGULAR DISTRIBUTION OF THE μ-DECAY AS TEST OF PARITY CONSERVATION.
N.N.Biswas, M.Ceccarelli and J.Crussard.
Nuovo Cimento (Ser. 10), Vol. 5, No. 3, 756-7 (March, 1957).
The angular distribution of positrons from 2003 selected μ^+ decays shows an asymmetry of the form $(1 - 0.095 \cos\theta)$, where θ is the angle between positron direction and initial muon direction.
J.W.G.Wignall

539.18

9917. ON THE ANGULAR CORRELATION IN $\mu-e$ DECAYS OBSERVED IN NUCLEAR EMULSIONS EXPOSED IN MAGNETIC FIELD. J.Heughebaert, M.René, J.Sacton and G.Vanderhaeghe.
Nuovo Cimento (Ser. 10), Vol. 5, No. 6, 1808-13 (June, 1957).
The asymmetry coefficient was measured for the decay of 831 μ-mesons in G5 emulsion which had been exposed to a beam of 37 MeV π^+-mesons in a magnetic field of 50-100 Oe. The value, $a = -0.22 \pm 0.12$, is within the range of previous determinations. It is shown that there is no need to determine the precession angle, and the method may allow an estimate of the depolarization by various factors. E.J.Burge

539.18

9918. CHANGE OF ISOTOPIC SPIN IN THE $K_{\pi 2}$ DECAY.
M.Gell-Mann.
Nuovo Cimento (Ser. 10), Vol. 5, No. 3, 758-60 (March, 1957).
Discusses, and compares with experiment, the predictions of the rules that in strange particle decays the isotopic spin changes by $\frac{1}{2}$, or by $\frac{1}{2}$ or 3/2, for the θ^0 branching ratio into $2\pi^0$ and $(\pi^+ + \pi^-)$ and the ratio of $K_{\pi 2}^+$ and θ^0 lives. J.W.G.Wignall

539.18

9919. D WAVE EFFECTS IN POSITIVE PION—PROTON SCATTERING. E.Clementel and C.Villi.
Nuovo Cimento (Ser. 10), Vol. 5, No. 5, 1343-8 (May, 1957).
The 270 and 307 MeV π^+—p scattering experiments are analysed assuming S, P, and D waves take part. Two possible sets of phase shifts are consistent with the observations. An experiment on recoil proton polarization, which could resolve this ambiguity, is suggested. J.W.G.Wignall

539.18

9920. K-MESON SCATTERING WITH CHANGE OF INTRINSIC PARITY. V.B.Berestetsky and Yu.A.Bychkov.
Nuclear Physics, Vol. 3, No. 2, 153-6 (April, 1957).
The general form of the scattering matrix is determined. See also Abstr. 6612 (1957). J.S.Bell

539.18

9921. ELASTIC SCATTERING OF A Σ^+ HYPERON FROM A FREE PROTON. F.C.Gilbert and R.S.White.
Phys. Rev., Vol. 107, No. 6, 1685-6 (Sept. 15, 1957).
An event was found in nuclear emulsion which is interpreted as an elastic scattering of a Σ^+ hyperon from a free proton. The centre-of-mass scattering angle was 125° and the energy of the hyperon at the point of scattering was 22.9 MeV. A.

539.18

9922. ON THE WEAK BARYON—π MESON INTERACTIONS.
B.d'Espagnat.
C.R. Acad. Sci. (Paris), Vol. 245, No. 9, 894-6 (Aug. 26, 1957). In French.
The baryon—pion interactions are written in a form which is invariant under rotation in isotopic space. If one assumes that one term of the interaction commutes with the parity operator and the other anticommutes, agreement of the Σ hyperon branching and lifetime ratios with the predictions of the $|\Delta I| = \frac{1}{2}$ rule can be obtained. J.W.G.Wignall

539.18

9923. HIGH-ENERGY π–He EXPERIMENTS: CHARGE SYMMETRY AND THE DETERMINATION OF THE K-MESON SPIN. J.J.Sakurai.
Phys. Rev., Vol. 107, No. 4, 1119-20 (Aug. 15, 1957).

The associated production of K particles and hypernuclei in high-energy π–He interactions is considered in order to verify charge symmetry at small distances, to determine conclusively the spin of the K meson (as long as angular momentum is conserved), and to detect a possible effect due to the nonconservation of angular momentum. A.

539.18

9924. ENERGY DEPENDENCE OF THE K^+-MESON INTERACTION CROSS SECTION. W.Widgoff, A.Pevsner, D.F.Davis, D.M.Ritson, R.Schluter and V.P.Henri.
Phys. Rev., Vol. 107, No. 5, 1430-3 (Sept. 1, 1957).

K^+ interactions in nuclear photographic emulsion were studied at three effective mean K^+ energies: 54 MeV, 95 MeV, and 140 MeV. The cross-section for inelastic interaction is found to increase slightly with energy. The scattering appears to be s-wave, T = 1, at low energies, with p-wave scattering becoming appreciable above about 100 MeV. A.

539.18

9925. INTERACTION CROSS-SECTION OF π-MESONS WITH NUCLEONS AT HIGH ENERGIES. P.V.Vavilov.
Zh. éksper. teor. Fiz., Vol. 32, No. 4, 940-1 (1957). In Russian.

The asymptotic behaviour of the interaction cross-section of π-mesons with nucleons with increasing energy, is calculated by using dispersion relations for forward scattering. Coulomb interaction is neglected. The asymptotic value is found to be 30 millibarns. G.Martelli

539.18

9926. ASSOCIATED PRODUCTION OF STRANGE PARTICLES. J.J.Sakurai.
Nuovo Cimento (Ser. 10), Vol. 5, No. 5, 1340-2 (May, 1957).

Perturbation theory calculation of angular distributions of K^0 and Λ^0 (or Σ^0) and of K^+ and Σ^-, in pion–proton collisions, assuming a direct pion–K meson interaction as well as the usual K-hyperon–nucleon interaction. Agreement with experiment can be obtained. J.W.G.Wignall

539.18

9927. MESON PRODUCTION IN MESON–NUCLEON COLLISION. E.Kazes.
Phys. Rev., Vol. 107, No. 4, 1131-5 (Aug. 15, 1957).

Meson production cross-sections are calculated by using the Chew–Low theory (Abstr. 2680/1956). The various production amplitudes, in the one-meson approximation, yield integral equations whose kernels involve scattering phase-shifts. For these, experimental or theoretical phase-shifts are used. Calculations with pseudoscalar mesons show that, for coupling constants deduced from scattering, the Born approximation differs greatly from the results of the one-meson approximation. Agreement with experiments at 470 MeV is good but not decisive. A.

539.18 : 537.534

LOW-ENERGY MESON BEAM FROM CYCLOTRON. See Abstr. 9728

539.18 : 539.172.13

S-WAVE PIONS FROM p + p REACTION. See Abstr. 9874

539.185

9928. A NOTE ON THE SLOWING-DOWN AREA IN IRON. C.C.Horton.
Atomic Energy Res. Establ. (Harwell) Mem. RP/M115, 4 pp. (1957).

The slowing-down area τ for fast neutrons diffusing in iron is calculated as a function of energy from the experimental values of the scattering cross-section. Neutron energies up to 2 MeV are considered. Above 1 MeV inelastic scattering is important and an estimate of the resulting reduction in τ is made. R.D.Smith

539.185 : 539.172.4

U^{235} FISSION-NEUTRON SPECTRUM. See Abstr. 9892

539.185.08 : 778.34

9929. MEASUREMENT OF NEUTRON SPECTRA BY USE OF NUCLEAR EMULSIONS LOADED WITH Li^6 GLASS SPECKS. J.H.Roberts and F.E.Kinney.
Rev. sci. Instrum., Vol. 28, No. 8, 610-15 (Aug., 1957).

Type E1 Ilford emulsions loaded with specks of Li^6 glass were studied for the measurement of neutron spectra from ~ 50 to 1000 keV. The method is independent of the neutron directions. Resolutions of about 200 keV were obtained. Calibrations were made by exposure to monoergic neutrons at several energies, and the method was tested by neutron spectra determined independently from fission and "long counter" data. The theory of the reduction of track data to neutron spectra is given. The results look promising for application to the measurement of neutron spectra in fast critical assemblies and for similar problems. A.

539.185.9 : 548.7

LATTICE IMPERFECTIONS IN LiF IRRADIATED WITH NEUTRONS. See Abstr. 9969

STRUCTURE OF SOLIDS 539.2

539.2

9930. ATTRACTIVE FORCES BETWEEN FLAT PLATES. M.J.Sparnaay.
Nature (London), Vol. 180, 334-5 (Aug. 17, 1957).

Describes the apparatus used to measure the attractive force between two chromium or chromium steel plates; the force per cm^2 was found to be $0.01\text{-}0.04 \times 10^{-16}\ d^{-4}$ dynes, where d is the distance between the plates. Discusses the effect of dust and of electric forces between the plates. J.M.Hough

539.21 : 539.58

9931. THE EFFECT OF NEUTRON IRRADIATION ON THE COMPRESSIBILITY OF METALS. A.I.Likhter and A.K.Kikoin.
Zh. éksper. teor. Fiz., Vol. 32, No. 4, 945 (1957). In Russian.

Irradiation of specimens of Al and Mg by fast neutrons (10^{19} per cm^2) did not affect their compressibility. J.B.Arthur

539.219 : 548.736.3

9932. METALLOGRAPHIC AND X-RAY INVESTIGATION OF ALLOYS IN THE SYSTEM ANTIMONY–IRIDIUM. R.N.Kuz'min, G.S.Zhdanov and N.N.Zhuravlev.
Kristallografiya, Vol. 2, No. 1, 48-50 (1957). In Russian.

The temperature–composition diagram of the system is given. The existence of two compounds, $IrSb_3$ and $IrSb_2$, is established; the density and micro-hardness of each is determined. $IrSb_2$ is monoclinic with $a = 6.6 \pm 0.2$ A, $b = 6.5 \pm 0.2$ A, $c = 6.7 \pm 0.2$ A, $\beta = 115 \pm 1^0$. R.F.S.Hearmon

539.219 : 548.74

9933. NEUTRON DIFFRACTION INVESTIGATION OF IRON–NICKEL ALLOYS OF THE PERMALLOY CLASS. B.G.Lyaschenko, D.F.Litvin, I.M.Puzeĭ and Yu.G.Abov.
Kristallografiya, Vol. 2, No. 1, 64-73 (1957). In Russian.

A single-crystal neutron spectrometer is described. It was used to investigate four Ni–Fe alloys of different composition. The influence of adding small amounts of Mo and Cr was also studied. Superlattice effects are discussed. R.F.S.Hearmon

539.27 : 539.234

9934. THE STRUCTURE OF THIN EVAPORATED LAYERS OF ARSENIC AND IODINE AT LOW TEMPERATURES. H.Grimminger and H.Richter.
Z. Naturforsch., Vol. 11a, No. 11, 942-5 (Nov., 1956). In German.

Layers of As, Sb, and I were evaporated at the temperature of liquid air and examined at that temperature by electron diffraction, as well as at temperatures up to room temperature. The As layers were amorphous throughout but changes in the electron diffraction pattern on heating suggested structural alterations. No such alterations occurred with Sb. With I a crystalline layer was observed except when the I was evaporated in the presence of oil, when an amorphous layer was again observed. This changed to crystalline at about -60^0 C. J.Thewlis

ELASTICITY. STRENGTH. RHEOLOGY

539.3/.8

539.32

9935. INTERNAL FRICTION OF SINGLE CRYSTAL SILICON FROM 25^0 C TO 1100^0 C. P.D.Southgate.
Proc. Phys. Soc. B, Vol. 70, Pt 8, 804-6 (Aug., 1957).

Measurements were made of the logarithmic decrement of half-wavelength bars of silicon vibrated at 100 kc/s. When the log dec. was plotted against the inverse of the absolute temperature two

maxima were seen, at 650 and 1020° C. Cooling the specimen from 1000° C over 2 hr and ½ hr respectively reduced the peak at 650° C by amounts dependent on the time taken, maximum reduction occurring at the shorter period. This phenomenon did not persist and the original curve was retraced on immediate reheating. Prestraining by twisting the specimen through 13° at 1000° C initially raised the higher temperature peak and widened the 650° C peak but these effects were removed by annealing at 1100° C for 2 days. This prestraining, however, had a permanent effect in that it prevented the quenching effect reported when the specimens were cooled slowly. Values are given for the activation energies associated with the peaks. A.C.Whiffin

539.32

9936. APPARATUS FOR PRECISE DETERMINATION OF DYNAMIC YOUNG'S MODULUS AND INTERNAL FRICTION AT ELEVATED TEMPERATURES. M.E.Fine.
Rev. sci. Instrum., Vol. 28, No. 8, 643-5 (Aug., 1957).

The resonant dynamic method with electrostatic transducers is used for metals at temperatures up to 800°C. The frequency range is 20 to 200 kc/s. Data for aluminium and tungsten are given. A.

539.371 : 548.732

INTENSITY CHANGE OF X-RAY LINES ON DEFORMATION OF POLYCRYSTALS. See Abstr. 9460

539.373

9937. OBSERVATIONS ON THE DISTRIBUTION OF SLIP IN POLYCRYSTALLINE COPPER. D.S.Kemsley.
Phil. Mag. (Eighth Ser.), Vol. 2, 1103-4 (Sept., 1957).

Previous workers have shown that slip in metals is encouraged, rather than prohibited, by prior deformation, on planes close to the first active ones. Observations have now been made on polycrystalline copper which demonstrate that slip bands are formed more readily as strain increases, the observations being made by a light microscope used to study the area around impressions made in the surface of the copper by a Vickers' diamond hardness machine. Diffuse slip bands were observed around the impression on a specimen not subjected to strain. After tension giving 1% plastic strain, sharper slip traces were observed, while after straining to 30% elongation, abundant clearly defined slip bands were present. A specimen tested in fatigue at ± 11 000 lb/in² for 6×10^6 cycles showed many clearly developed slip traces in a relatively small area around the hardness impression. A.C.Whiffin

539.4.011.25 : 537.226.2 : 621.315.612

9938. MECHANICAL STRENGTH OF RADIOFREQUENCY CERAMICS AS INFLUENCED BY HEAT TREATMENT.
N.P.Bogoroditskiĭ, G.V.Boĭs, M.N.Kozlovskaya and M.I.Neĭman.
Zh. tekh. Fiz., Vol. 27, No. 4, 675-81 (1957). In Russian.

The mechanical strength of radiofrequency ceramics is intimately connected with formation of an interstitial layer between the crystallites, progressive crystallization in which may lead to microcrack formation. This is strongly influenced by anneals above critical temperature of crack-formation. Also, mechanical and dielectric strengths of ceramics are closely related. Formation of micro-cracks reduces dielectric strength roughly by one order of magnitude. Electrical Research Association

539.58 : 539.21

THE EFFECT OF NEUTRON IRRADIATION ON THE COMPRESSIBILITY OF METALS. See Abstr. 9931

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM. CHEMICAL REACTIONS 541.11/.12

541.124

9939. ISOTOPIC EXCHANGE REACTIONS. THE HALOGEN EXCHANGE BETWEEN $SiCl_4$ AND HCl. R.H.Herber.
J. chem. Phys., Vol. 27, No. 3, 653-5 (Sept., 1957).

The kinetics of the isotopic chlorine exchange between $SiCl_4$ and and HCl was studied using the tracer Cl^{36}. The reaction is first order in HCl and second order in $SiCl_4$. A mechanism for the exchange is proposed. A.

541.124

9940. KINETICS OF COMPLEX ISOTOPIC EXCHANGE REACTIONS. D.F.Abell, N.A.Bonner and W.Goishi.
J. chem. Phys., Vol. 27, No. 3, 658-60 (Sept., 1957).

A general equation is developed for the kinetics of complex isotopic-exchange reactions in which each of three nonequivalent species is exchanging with the other two. A.

541.126 : 536.46

9941. BURNING OF A LIQUID DROPLET. III. CONDUCTIVE HEAT TRANSFER WITHIN THE CONDENSED PHASE DURING COMBUSTION. H.Wise and C.M.Ablow.
J. chem. Phys., Vol. 27, No. 2, 389-93 (Aug., 1957).

For Pt II see Abstr. 7780/1956. The problem of internal heating by conduction during the combustion of a spherical fuel droplet is examined. The analysis indicates that the temperature pattern within such a system is governed by the dimensionless ratio of burning rate coefficient to thermal diffusivity of the liquid. During combustion the temperature in the centre of the droplet may closely approach the surface temperature for liquid fuels commonly employed in propulsion. Such an increase in temperature may lead to thermal degradation and carbon formation observed during the combustion of certain organic compounds. A.

541.126 : 536.46

9942. BURNING OF A LIQUID DROPLET. IV. COMBUSTION INHIBITION IN A FUEL–OXIDIZER SYSTEM.
B.J.Wood, H.Wise and W.A.Rosser.
J. chem. Phys., Vol. 27, No. 3, 807-8 (Sept., 1957).

For Pt III see preceding abstract. Mass burning rates for ethanol in air plus inhibitor were measured, using a porous sphere, to which fuel was supplied at a rate sufficient just to maintain the flame. Small concentrations of HBr, CH_3Br or CF_3Br produced extinction, but the mass burning rate was unaffected. For N_2, 30% was required for extinction and the burning rate then fell. A.G.Gaydon

541.127

9943. THERMAL CIS–TRANS ISOMERIZATION OF DICHLOROETHYLENE: AN UNEXCEPTIONAL REACTION.
B.S.Rabinovich and M.J.Hulatt.
J. chem. Phys., Vol. 27, No. 2, 592-3 (Aug., 1957).

The isomerization of the trans compound was re-investigated at a pressure of 11 cm and temperatures of 275° - 330° C. Some fifty runs were performed with a variety of seasoning methods and treatment of the 2-litre fused silica reactor bulb. Rate constants were reproducible to within about 50% and were very much smaller than the existing irreconcilably different values which suggests that the reaction is not, as had formerly been concluded, an exceptional one i.e. one proceeding by two mechanisms to the same products. W.Good

541.128

9944. IMPROVED MOLYBDENUM SEPARATION PROCEDURE.
E.M.Scadden.
Nucleonics, Vol. 15, No. 4, 102 (April, 1957).

Details of a shortened method of separating Mo from fission product mixtures, resulting in a saving in time without loss in purity of the product. R.D.Smith

ELECTROCHEMISTRY 541.13

541.135.5

9945. EFFECT OF POISONED SITES ON THE ELECTRICAL ANALOG OF A METAL/SOLUTION INTERFACE.
S.Schuldiner and J.P.Hoare.
J. chem. Phys., Vol. 26, No. 6, 1771-2 (June, 1957).

The effect of arsenic on the time–potential behaviour of a platinum cathode is to produce a polarization decay other than the solution IR drop. The reduction in catalytic activity of a metal surface

by poisoning can now be interpreted in terms of an electrical analogue comprising a series of electrical components associated with active and inactive sites. W.Good

541.135.5

9946. MECHANISM OF ELECTROLYTIC SILVER DEPOSITION AND DISSOLUTION. W.Mehl and J.O'M.Bockris.
J. chem. Phys., Vol. 27, No. 3, 818-19 (Sept., 1957).

PHOTOCHEMISTRY. RADIATION CHEMISTRY 541.14/.15

541.14

9947. PHOTOISOMERIZATION EQUILIBRIA IN AZODYES. E.Fischer and Y.Frei.
J. chem. Phys., Vol. 27, No. 1, 328-30 (July, 1957).

From a study of the spectral absorption curves of 4-dimethylamino-azobenzene in toluene at – 60°C the dependence of the photoisomerization equilibrium on the wavelength of the irradiating light was determined. The activation energy for the spontaneous (thermal) cis → trans conversion was measured and found to be 21 kcal/mole. W.Good

541.14

9948. PHOTOISOMERIZATION EQUILIBRIA INVOLVING THE C=N DOUBLE BOND. E.Fischer and Y Frei.
J. chem. Phys., Vol. 27, No. 3, 808-9 (Sept., 1957).

541.15

9949. ABSORPTION OF RADIATION BY A CYLINDRICAL SAMPLE OF A STRONG ABSORBER. W.H.Clingman, Jr.
J. chem. Phys., Vol. 27, No. 1, 322-3 (July, 1957).

A function is derived for the rate of energy absorption by a cylindrical sample irradiated by a parallel beam of ionizing radiation at right angles to its axis. Numerical values are calculated for samples of different total mass absorption coefficients and different radii. M.Ebert

541.15

9950. RADIOLYSIS OF SOLID NITRATES.
C.J.Hochanadel and T.W.Davis.
J. chem. Phys., Vol. 27, No. 1, 333-4 (July, 1957).

The dried nitrates of Cs, K, Na, Li, Ag, Ba, Pb and La were irradiated with Co^{60} gamma-radiation at 1.5×10^{17} eV g^{-1} min^{-1}. The nitrite production was measured and was linear up to 5×10^{20} eV g^{-1}. The relative G-values depend on the cation in a similar manner as the relative quantum yields for ultraviolet decomposition. This similarity is more marked if the G-values are divided by the ratio of electrons in the nitrate ion to the total number of electrons. The likely reaction mechanism for both types of radiation is dissociation of the excited NO_3^- ion into NO_2^- and O. The O either recombines or reacts with an adjacent NO_3^- to give $NO_2^- + O_2$. M.Ebert

541.15

9951. FORMATION OF REVERSIBLE COLORED MODIFICATIONS AT LOW TEMPERATURES BY BOMBARDMENT WITH ELECTRONS. Y.Hirshberg.
J. chem. Phys., Vol. 27, No. 3, 758-63 (Sept.,1957).

The effects of electron irradiation at low temperatures upon a number of bianthrone and spiropyran compounds was examined. The colours induced were found to be very similar in properties to those obtained by ultraviolet irradiation of the same compounds. A.

541.15

9952. HOW RADIATION AFFECTS ORGANICS IN SOLVENT EXTRACTION OF FUEL. J.H.Goode.
Nucleonics, Vol. 15, No. 2, 68-71 (Feb., 1957).

In tributyl–phosphate–naphtha extraction systems for recovering U, Pu and Th from irradiated reactor fuels solvent radiation damage is noticeable at 0.5 W hr/l. First effect is formation of dibutyl and monobutyl phosphate and a decrease in the decontamination factor. Higher doses result in appreciable loss of stripping efficiency and a tendency towards emulsification. However the process is not seriously affected below 20 W hr/l. R.D.Smith

541.15

9953. CHEMICAL EFFECTS OF HOT ATOMS.
L.Monchick, K.Funabashi and J.L.Magee.
J. chem. Phys., Vol. 27, No. 3, 734-9 (Sept., 1957).

A model is presented for the study of the chemical effects which result from the passage of energetic atoms through liquid or gaseous media. The particular case of energetic Br atoms in CH_3Br is treated in detail. The average rate of energy loss, the range, and the number of C–Br bonds broken in primary events are calculated. The track structure and the nature of chemical effects are discussed. A.

DISPERSIONS. COLLOIDS. ADSORPTION 541.18

541.183.26

9954. STUDY OF THE STATE OF NITROGEN ADSORBED ON EVAPORATED BARIUM FILM. Y.Sasaki.
J. chem. Phys., Vol. 27, No. 1, 281-5 (July, 1957).

In order to clarify the nature of activated adsorption, the adsorption of nitrogen on a freshly evaporated barium film, the replacement of the adsorbed nitrogen by oxygen and the liberation of the nitrogen by means of electron impact were studied. Immediately after the adsorption a portion of the activated adsorbed nitrogen is bound loosely to the surface of the barium, and is gradually converted to a state of firmer binding which is similar to that involved in a chemical reaction. The loosely bound nitrogen was ascertained to be in a molecular state, its electronic configuration being not much perturbed from the ground state of nitrogen $X^1\Sigma_g^+$. The existence of the ionized nitrogen molecule $N_2^+(^2\Sigma_g^+)$ on the metal surface is suggested. A.

CHEMICAL STRUCTURE 541.2/.6

541.64

9955. ORIENTATION IN POLYETHYLENE TEREPHTHALATE FILM. C.Y.Liang and S.Krimm.
J. chem. Phys., Vol. 27, No. 1, 327-8 (July, 1957).

Describes study of the orientation of benzene rings in stretched films by experiments on the effect of specimen tilting on absorption of polarized infrared radiation. J.Hawgood

541.64 : 534.22

TEMPERATURE DEPENDENCE OF ULTRASONIC VELOCITY IN PLASTICS. See Abstr. 8471

541.66 : 532.74

SOME PROPERTIES OF LIQUID SULPHUR AND THE OCCURRENCE OF LONG CHAIN MOLECULES. See Abstr. 8452

CHEMICAL ANALYSIS 543/545

545.82

9956. ANALYSIS OF REFRACTORY OXIDES FOR HALOGENS. M.P.Chaĭka.
Optika i Spektrosk., Vol. 2, No. 4, 421-5 (1957). In Russian.

Details are given of the spectroscopic analysis of F and Cl in U_3O_8 and ThO_2 in which the spectra are excited in an iron hollow cathode with helium as the carrier gas. The influence of the cathode dimensions on halide evolution is given in tables. It is claimed that 10^{-4}% F concentration in U_3O_8 may be estimated with 10% error on a minimum 10 mg sample. L.Bovey

545.827

9957. THE DETERMINATION BY RADIOACTIVATION OF TRACE QUANTITIES OF ARSENIC, ANTIMONY AND COPPER IN PURE SILICON. A.A.Smales, D.Mapper, A.J.Wood and L.Salmon.
Atomic Energy Res. Establ. (Harwell), Rep. C/R2254, 17 pp. (1957).

A method is described for the determination of arsenic, antimony and copper in pure silicon semiconductor material. The method involves irradiation of the silicon in the Harwell Pile, followed by radiochemical separation of the individual elements using carriers and, finally, comparison of the radioactivity due to these elements from the samples with that from known amounts of the elements that were irradiated simultaneously. The results obtained on 10 samples of silicon for arsenic varied from 0.002 to 22.6 parts per million (p.p.m.), for antimony from 0.001 to 0.88 p.p.m., and for copper from 0.001 to 3.1 p.p.m., the inhomogeneity of a number of the samples being one of the difficulties encountered. A.

CRYSTALLOGRAPHY 548

548.1

9958. ON THE SUPERPOSITION OF SYMMETRY GROUPS IN CRYSTAL PHYSICS. V.A.Koptsik.
Kristallografiya, Vol. 2, No. 1, 99-107 (1957). In Russian.

A mathematical treatment of tensor equations in an anisotropic medium, illustrated with reference to the thermal expansion, piezoelectricity and elasticity matrices in quartz. R.F.S.Hearmon

548.24 : 535.25

9959. ON THE POSSIBILITY OF DETECTING DAUPHINÉ TWINNING IN QUARTZ BY AN OPTICAL METHOD.
V.L.Indenbom.
Kristallografiya, Vol. 2, No. 1, 83-8 (1957). In Russian.

Using the equations for the photoelastic effect in quartz, the additional double refraction under stress due to twinning is calculated for observations along and perpendicular to the z-axis. In the former case, allowance is made for optical activity. The possibility of detecting twinning from the electro-optical effect is also discussed. R.F.S.Hearmon

548.3

9960. RELATIONS BETWEEN THE STRUCTURE OF BLENDES AND THEIR GALLIUM AND INDIUM CONTENT. G.Rigault.
Nuovo Cimento (Ser. 10), Vol. 5, No. 3, 579-86 (March, 1957). In Italian.

Suggests an explanation, in terms of crystal structure, for the observed correlation between temperature of formation, and gallium, indium and zinc content of blendes (G.Rigault, Periodico di Mineralogia, Vol. 25, 43, 1956). The possibility of the formation of indium in situ by nuclear transformation is also discussed. A.R.Stokes

548.5 : 541.135

9961. ON THE USE OF THE NERNST EQUATION IN THE THEORY OF ELECTROLYTIC CRYSTAL GROWTH.
D.A.Vermilyea.
J. chem. Phys., Vol. 27, No. 3, 822-3 (Sept., 1957).

548.5

9962. THE EFFECT OF ULTRASOUND ON THE CRYSTALLIZATION OF ALUMINIUM POTASSIUM ALUMS.
A.P.Kapustin and V.E.Kavalyunaĭte.
Kristallografiya, Vol. 1, No. 6, 737-8 (1956). In Russian.

Crystal faces of specimens grown in the presence of an ultrasonic field (2 Mc/s) were found to increase their dimensions at a greater rate than in the absence of field. R.F.S.Hearmon

548.5 : 548.74

9963. ELECTRON MICROSCOPY OF TIN WHISKERS USING CARBON REPLICAS. D.E.Bradley, J.Franks and P.E.Rush.
Proc. Phys. Soc. B, Vol. 70, Pt 9, 889-92 (Sept., 1957).

Electron microscopic examination of whiskers, grown by compressing electrodeposited tin layers, showed that they commonly appeared as ribbons 1-5 μ wide and 0.1 μ thick, often with a fine structure. A variety of other shapes was also observed. J.Franks

548.52

9964. RATE OF GROWTH OF ICE CRYSTALS IN SUPERCOOLED WATER.
C.S.Lindenmeyer, G.T.Orrok, K.A.Jackson and B.Chalmers.
J. chem. Phys., Vol. 27, No. 3, 822 (Sept., 1957).

Measurements of the growth rate of ice in supercooled water, free and on glass and brass surfaces, showed that Hillig and Turnbull's relationship (Abstr. 5518/1956) is not entirely general. The growth rate is limited by the conduction of latent heat. J.Franks

548.57 : 535.345

9965. GROWTH AND OPTICAL ABSORPTION OF SrS SINGLE CRYSTALS. G.Cheroff, M.Okrasinski and S.P.Keller.
J. chem. Phys., Vol. 27, No. 1, 330-1 (July, 1957).

SrS single crystal plates (1 mm x 1 mm) were grown from the melt, and needles (5 mm x 0.1 mm) were obtained by sublimation; the furnace is described. At one atmosphere, SrS melts between 2600° C and 2800° C, and readily sublimes at 2150° C. The absorption edge is at 306 mμ, and the energy gap is 4.1 eV. J.Franks

548.574

9966. CHEMICAL ETCHES AND ETCH PIT PATTERNS ON PbS CRYSTALS. R.F.Brebrick and W.W.Scanlon.
J. chem. Phys., Vol. 27, No. 3, 607-8 (Sept., 1957).

Chemical etches have been found which polish or remove thick surface layers from PbS crystals. One of these etches results in the formation of etch pits. The dissolving action of this etch on PbS, PbSe, and PbTe and the etch pit patterns formed by it on natural and synthetic PbS crystals are discussed. A.

548.574

9967. ETCH PITS IN SILICON SINGLE CRYSTALS.
Y.Matukura and T.Suzuki.
J. Phys. Soc. Japan, Vol. 12, No. 8, 976 (Aug., 1957).

(111) planes of silicon were etched with an acid mixture containing KNO_3. Etchpits of various sizes formed, some containing spiral terraces. J.Franks

ATOMIC AND X-RAY CRYSTALLOGRAPHY

548.7

548.7 : 535.343

9968. CRYSTALLINE FIELD SELECTION RULES: THE EFFECT OF VIBRATION–ELECTRONIC INTERACTION. R.A.Satten.
J. chem. Phys., Vol. 27, No. 1, 286-9 (July, 1957).

It is pointed out that the selection rules for stationary ions in crystalline electric fields are violated for many transitions in the neodymium bromate and ethylsulphate absorption spectra, making it impossible consistently to assign irreducible representations to crystalline levels. The appearance of spectral lines not obeying the usual crystalline field selection rules is assumed to be due to the interaction of the vibration of the rare earth ion or ion–water complex with its electronic motion about the nucleus. The theory of such an interaction is presented and selection rules derived for D_{3h}, C_{3v}, D_3, C_3, and C_{3h} local symmetries about the equilibrium position. It is found that the vibration interaction can account for the type of violations seen and with intensities that are probably comparable to some allowed pure electronic transitions. A satellite structure, which is a consequence of the vibration–electronic interaction, is predicted for all spectral lines except transitions between upper and lower $J = \frac{1}{2}$ or $J = 0$ levels. Such a structure may be manifested experimentally as a high-temperature "line width". Such satellites of pure electronic transitions should obey the same selection rules and have the same Zeeman effect as the "parent" pure electronic transition. The intensity of the individual satellite components of a line does not depend on the strength of the vibration–electronic interaction but only on the Boltzmann factors of their lower state and on the intensity of the parent line. A.

548.7 : 539.185.9

9969. LATTICE IMPERFECTIONS IN LiF IRRADIATED WITH NEUTRONS: AGGREGATES OF INTERSTITIAL ATOMS.
M.Lambert and A.Guinier.
C.R. Acad. Sci. (Paris), Vol. 245, No. 5, 526-9 (July 29, 1957). In French.

Irradiated LiF shows additional X-ray scattering corresponding to scattering vectors localized in the ⟨100⟩ directions of reciprocal space. The variation in scattered intensity along a ⟨100⟩ direction is analysed and interpreted as due to the coagulation of the interstitial Li atoms, formed on irradiation, into interstitial layers parallel to the {100} crystal planes. The effect has been studied as a function of neutron dose and subsequent thermal treatment. A.B.Lidiard

548.7

9970. DISLOCATIONS OBSERVED IN A SILVER CHLORIDE CRYSTAL. J.W.Castle.
J. appl. Phys., Vol. 28, No. 6, 743 (June, 1957).

The surfaces of AgCl crystals were illuminated by a succession of microsecond light pulses with simultaneous application of voltage pulses to draw the photoelectrons into the interior of the crystal. The photoelectrons being trapped at dislocations, the resulting decoration by photolytic silver enabled single dislocations to be observed. Approximately 10^5 dislocation-lines/cm^2 were counted. A.B.Lidiard

548.7

9971. HOLE AND CLAW DEFECTS IN GRAPHITE.
A.R.Ubbelohde.
Nature (London), Vol. 180, 380 (Aug. 24, 1957).

Discusses lattice defects which may arise from the formation of chemical bonds with foreign atoms by the carbon σ-electrons: (1) if the carbon network is complete an original σ-bond can allow two bound atoms or radicals, (2) a missing carbon atom would allow three new bonds corresponding to the three unpaired

σ-electrons of the neighbours. The binding of two or three atoms in these positions could lead to bulging and buckling of the graphite layer. Alternatively, lower energies might be obtained for case (1) by binding only one foreign atom, leaving the remaining σ-electron unpaired. A.B.Lidiard

548.7

9972. EVIDENCE FROM MOIRÉ PATTERNS OF PACKING FAULTS IN BORON NITRIDE CRYSTALS. J.F.Goodman.
Nature (London), Vol. 180, 425-7 (Aug. 31, 1957).

Moiré fringes obtained with BN crystals, observed under electron-microscope bright-field and dark-field illumination, may be due to packing faults involving a small twist about the c-axis. J.Franks

548.7

9973. A NEW METHOD FOR DECORATING DISLOCATIONS IN CRYSTALS OF ALKALI HALIDES.
D.J.Barber, K.B.Harvey and J.W.Mitchell.
Phil. Mag. (Eighth Ser.), Vol. 2, 704-8 (May, 1957).

Decoration of dislocations in alkali bromides and chlorides is possible by heating the crystals (500°C to 700°C) with the corresponding gold halide ($HAuBr_4$, $HAuCl_4$) in evacuated tubes. Decoration with gold then occurs on cooling the crystal and under favourable circumstances is continuous along the dislocation lines with little precipitation elsewhere. This method has been used to observe (1) arrays of dislocations in the glide planes of lightly deformed KBr and NaCl crystals, (2) dislocation walls in a heavily deformed NaCl crystal subsequently polygonized by heating at 700°C, (3) systems of dislocation rings arranged on ⟨110⟩ axes, and also helical dislocations, in lightly deformed NaCl crystals. A.B.Lidiard

548.7 : 548.574

9974. THE ETCHING OF DISLOCATIONS IN CRYSTALS OF SILVER HALIDES. D.A.Jones and J.W.Mitchell.
Phil. Mag. (Eighth Ser.), Vol. 2, 1047-50 (Aug., 1957).

Photographs are shown of dislocations associated with both annealing and deformation structures, as revealed by etching and decoration techniques. B.T.M.Willis

548.7 : 548.574

9975. ETCH PITS IN INDIUM ANTIMONIDE.
W.Bardsley and R.L.Bell.
J. Electronics and Control, Vol. 3, No. 1, 103-5 (July, 1957).

Describes an etch technique for revealing the distribution of edge dislocations on the {111} faces of InSb. Two photomicrographs. W.Bardsley

548.7 : 539.219.2

9976. DENSITY CHANGE OF A CRYSTAL CONTAINING DISLOCATIONS. W.M.Lomer.
Phil. Mag. (Eighth Ser.), Vol. 2, 1053-4 (Aug., 1957).

The decrease in density of copper produced by one dislocation is calculated by a simple argument. The volume increases by nearly 2Ω per atomic length of dislocation line (Ω = atomic volume). B.T.M.Willis

548.7

9977. HELICAL DISLOCATIONS. J.Weertman.
Phys. Rev., Vol. 107, No. 5, 1259-61 (Sept. 1, 1957).

The equilibrium form of a dislocation line is shown to be a helix. If the helix is to contain many turns, its axis must be practically parallel to the Burgers vector. Pure screw dislocations can spontaneously assume the form of helices of many turns at large chemical stresses. A.

548.7

9978. PARAMAGNETIC RESONANCE OF IMPURITIES IN NaF.
B.Bleaney and W.Hayes.
Proc. Phys. Soc. B, Vol. 70, Pt 6, 626-8 (June, 1957).

A weak electron resonance signal in NaF is much enhanced on irradiation with gamma-rays from Co^{60} or 150 kV X-rays. It has $g = 4.344 \pm 0.002$ and a fine structure due to interaction with F^- ions and is attributed to Fe^+ on a cation site. There is a weak line $g = 1.998 \pm 0.002$ developed with electron irradiation which is tentatively attributed to Cr^+ and in many cases a pink colour is developed which is unrelated to the observed resonances. D.H.Whiffen.

548.7 : 535.37

COLOUR CENTRES IN IONIC CRYSTALS. See Abstr. 9625

548.73/.74

X-RAY AND ELECTRON INVESTIGATION OF MATERIALS. See also under "Structure of solids". Decimal classification 539.26/.27

548.734 : 548.74

9979. THE THEORY OF THE METHOD OF RADIAL DISTRIBUTION. B.K.Vaĭnshteĭn.
Kristallografiya, Vol. 2, No. 1, 29-37 (1957). In Russian.

A new method of normalizing the X-ray or electron diffraction intensity curve is suggested. In analysing the peaks of the radial distribution function, it is necessary to know only the relative weights of the atoms. The dependence of the magnitude of the peaks on atomic number is clarified. R.F.S.Hearmon

548.735

9980. PRECISION DETERMINATION OF CELL DIMENSIONS BY THE BACK-REFLEXION WEISSENBERG METHOD. F.H.Herbstein.
Nature (London), Vol. 180, 291-2 (Aug. 10, 1957).

Describes how a front-reflection Wiessenberg camera may be converted to take back-reflection photographs. A.R.Stokes

548.735

9981. SOME RELATIONS BETWEEN CRYSTAL STRUCTURES. I. CHEMICAL ELEMENTS. K.Schubert.
Z. Naturforsch., Vol. 11a, No. 11, 920-34 (Nov., 1956). In German.

A "position-correlation" function is proposed which measures the average probability of finding two electrons at a given vector distance apart in a crystal or liquid or gas structure. It is shown how this function may be used in the interpretation of structures of a number of elements and alloys. A.R.Stokes

548.736.1

9982. CRYSTAL STRUCTURE OF ALPHA-PLUTONIUM METAL.
W.H.Zachariasen and F.Ellinger.
J. chem. Phys., Vol.27, No. 3, 811-12 (Sept., 1957).

548.736.3

9983. STUDY OF THE WURTZITE-TYPE BINARY COMPOUNDS. II. MACROSCOPIC THEORY OF THE DISTORTION AND POLARIZATION. F.Keffer and A.M.Portis.
J. chem. Phys., Vol. 27, No. 3, 675-82 (Sept., 1957).

For Pt I, see Abstr. 2850 (1957). The slight departure of wurtzite-type binary compounds from ideal c/a ratio and ideal sublattice displacement parameter u is accounted for by the forces arising from partial polar binding. These long-range forces are calculated in terms of a postulated charge ±fe per ion and certain lattice sums which are evaluated. When balanced against the elastic, piezoelectric, and dielectric constants of the crystal, the forces account for both the direction and the order of magnitude of the distortion. The compounds AlN, BeO, and ZnO are considered in detail. An experimental value of 8.5 is given for the dielectric constant of AlN, but in the absence of precise values for elastic and piezoelectric constants only an order of magnitude check of the theory can be made. Some remarks are appended on the general problem of finite lattice sums in complex lattices which have dipole and/or quadrupole moments in the unit cell. A.

548.736.3 : 539.219

X-RAY INVESTIGATION OF THE SYSTEM ANTIMONY-IRIDIUM. See Abstr. 9932

548.736.4

9984. A DETERMINATION OF THE HYDROGEN POSITIONS IN $Ca(OH)_2$ BY X-RAY DIFFRACTION. H.E.Petch.
Canad. J. Phys., Vol. 35, No. 8, 983-5 (Aug., 1957).

The hydrogen-atom positions were obtained from a Fourier synthesis of $F_{obs.}-F_{calc.}$ The structure differs from that proposed by Mara and Sutherland (Abstr. 279/1954) on the basis of the infrared absorption spectrum. A.R.Stokes

548.74

9985. ON THE DETERMINATION OF LATTICE CONSTANTS BY ELECTRON DIFFRACTION. K.Meyerhoff.
Z. Naturforsch., Vol. 12a, No. 1, 23-7 (Jan., 1957). In German.

Various substances were examined as possible reference materials for use with an electron diffraction camera of high resolution. TlCl was chosen, and if the X-ray value of the lattice constant is assumed the value obtained for layers of tempered Ag also agrees with the X-ray value. The precision claimed is 0.01% The technique was applied to a study of the deposition of alkali halides on metals and to a series of metal oxides. The nature and cause of errors of measurement are discussed. J.Thewlis

548.74 : 537.533.35

[ELECTRON] MICROSCOPE AND REFLECTION-DIFFRACTION CAMERA. See Abstr. 9717

GEOPHYSICS 55

550.341

9986. EVIDENCE RELATING TO THE EARTH'S INNER CORE FROM HYDROGEN BOMB EXPLOSIONS IN 1954.
K.E.Bullen and T.N.Burke-Gaffney.
Nature (London), Vol. 180, 49-50 (July 6, 1957).

Seismic waves from the explosions have been observed. In addition to waves (PKIKP) which have passed through the inner core of the Earth, earlier arrivals attributed to diffraction of waves which did not reach the inner core (PKP) have been observed. A.H.Cook

550.384

9987. VARIATION OF THE HORIZONTAL FORCE NEAR THE MAGNETIC EQUATOR. N.S.Alexander and C.A.Onwumechilli.
Nature (London), Vol. 180, 191-2 (July 27, 1957).

Measurements of the variation of the horizontal component of the earth's magnetic field H at latitudes between 3^0 N and 3^0 S of the magnetic equator can be explained by the superposition of the effects of a narrow equatorial electro-jet on a more general field which varies appreciably with latitude. The results suggest that fluctuations in H arise mainly from minor fluctuations of the electro-jet itself. The equatorial electro-jet must be very narrow, probably $2\text{-}3^0$ wide. A.E.De Barr

550.384 : 523.746

9988. GEOMAGNETIC EFFECTS OF THE NORTHERN AND SOUTHERN SOLAR HEMISPHERES. W.Gleissberg.
Naturwissenschaften, Vol. 44, No. 6, 176-7 (1957). In German.

A table correlates, for every day of the five complete sunspot cycles between 1889 and 1943, means of the internationally defined geomagnetic variables C_i calculated for three groups of heliocentric latitudes B_0 (namely, those within 1^0 of the solar equator, north of 5^0, and south of -5^0). The results are: the C_i are smallest for the equator region; during 1889-1900 the southern solar hemisphere was more preponderant than in the following cycle, afterwards North became more active, but after 1933 the South exceeded again. From a discussion of possible explanations it is concluded that the cause might be a real change from hemisphere to hemisphere in the intensity of the emitted particle radiation. A.Beer

551.463

9989. MEASUREMENT OF THE ELECTRICAL CURRENT IN AN OCEAN. Yu.G.Ryzhkov.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 4, 787-90 (1957) In Russian.

Presents the results of measurements of telluric currents in oceans, made during the voyage of the Soviet ship "Ob". Special Pb electrodes (cf. Korneva, Dokl. Akad. Nauk SSSR, Vol. 76, No. 1 and Vol. 80, No. 6, 1951) and the PPTV-1 potentiometer were used; the measuring base was 200 or 300 m (in the Antarctic), and 130 m (the length of the ship) in other places. It was found that: (1) in the Antarctic (66^0 28.5' S, 94^0 44.0' E) the gradient, current density and direction of the electric current were (a) 4.2 mV/km, 1.14×10^{-9} A/cm^2 and 346^0, (b) 5.9 mV/km, 1.63×10^{-9} A/cm^2 and 341^0, and (c) 7.0 mV/km, 1.90×10^{-9} A/cm^2 and 343^0, at depths of 0-10, 100 and 200 m, respectively, the vertical potential gradient being 3.5 mV/km; (2) in the region of the latitude "focus" (maximum of the latitude component of the earth's magnetic field) (64^0 25.5' S and 92^0 44.0' E.): (a) 9.0 mV/km, 2.41×10^{-9} A/cm^2, 267^0, and (b) 41.0 mV/km, 1.2×10^{-8} A/cm^2 and 304^0, for the depths of 100 and 500 m, respectively, the vertical potential gradient being 4.9 mV/km; (3) in the region of magnetic equator (10^0 8' N and 51^0 40' E) the figures were (a) 7.1 mV/km, 3.37×10^{-9} A/cm^2 and 300^0, (b) 55.0 mV/km, 2.19×10^{-8} A/cm^2 and 324^0, and (c) 53.8 mV/km, 2.14×10^{-8} A/cm^2 and 315^0 at the depths of 100, 500 and 550 m (sea bottom), the vertical potential gradient being 7.5 mV/km. F.Lachman

ATMOSPHERE. METEOROLOGY 551.5

551.508.25

9990. SPECTROHELIOMETER FOR CONTINUOUSLY MONITORING SOLAR RADIATION IN FIVE WAVELENGTH BANDS. Y.T.Sihvonen.
Rev. sci. Instrum., Vol. 28, No. 8, 628-34 (Aug., 1957).

An instrument that quantitatively records and integrates solar radiation has been developed and put into operation. This instrument records and integrates automatically from sunrise to sunset. Total radiation is measured in addition to sampling radiation in five distinct spectral regions: 3095-3260 A, 3410-3630 A, 3865-4150 A, 4420-4900 A, and 5385-6295 A. Solar power in these bands as low as 10^{-5} watt per cm^2 has been quantitatively measured. The bandwidths intercepted are accurate to ± 15 A with an estimated ± 5 to 8% maximum error in determining absolute solar power and energy. A.

551.508.5 : 522.61

FILTER FOR OBSERVING THE POLAR AURORAE AND LUMINESCENCE OF THE UPPER ATMOSPHERE. See Abstr. 9494

551.521.6

9991. ABSORPTION OF SUNLIGHT BY ATMOSPHERIC SODIUM. J.A.Scrimger and D.M.Hunten.
Canad. J. Phys., Vol. 35, No. 8, 918-27 (Aug., 1957).

A photometer was used which was sensitive to light only in a very narrow spectral region near the sodium D lines. The light is scattered by sodium vapour at low density and the scattered light recorded by a photoelectric spectrometer. The latter resolves the two lines and allows the effect of stray light to be eliminated. With sunlight as the source, the radiation detected is at the bottom of the Fraunhofer lines and the residual intensity there may be measured. It was found that this intensity decreases slightly (relative to the continuum) as the sun approaches the horizon. This effect is attributed to atmospheric sodium; the amount found by this method agrees well with that deduced from twilight measurements. The thickness of the sodium layer in atoms/cm^2 varies between 3 and 9×10^9 in winter and is about 1×10^9 in April. The measurements also give the residual intensities of the Fraunhofer lines in the incident sunlight, averaged over the whole of the sun's disk. These are (5.90 ± 0.46)% for D1 and (5.06 ± 0.24)% for D2. A.

551.521.9 : 551.594.5

9992. A POSSIBLE AURORAL ENHANCEMENT OF INFRA-RED RADIATION EMITTED BY ATMOSPHERIC OZONE. W.B.Murcray.
Nature (London), Vol. 180, 139-40 (July 20, 1957).

An exceptionally large increase in the intensity of atmospheric O_3 emission at 9.6 μ was observed at College, Alaska, on March 26, 1957 at about 11.55 p.m. The spectrometer was pointing in a direction some 20 degrees above the S horizon, and the observed increase followed the S movement of an aurora into the sky field covered by the instrument. Half-an-hour earlier the O_3 emission was normal. The anomaly suggests an enhancement by the auroral activity, either by an increase in temperature of the ozonosphere above 40 km, or by an actual change in the concentration of O_3 molecules. The auroral radiation responsible for such a change is, in all probability, of wavelength < 3000 A. D.R.Barber

551.594.5 : 551.524.7

9993. ROTATIONAL TEMPERATURES MEASURED IN AURORAE AT CHURCHILL, MANITOBA. R.Montalbetti.
Canad. J. Phys., Vol. 35, No. 8, 831-6 (Aug., 1957).

A series of auroral spectra showing the 0-0 N_2^+ band was obtained. Rotational temperatures ranging from 230^0K to 480^0K are deduced. These are in agreement with measurements made at Saskatoon, Saskatchewan, and indicate that there is no latitude effect. A vertical temperature gradient of some 6 deg K/km is suggested by the observations. A.

551.594.6 : 551.510.53

9994. A METHOD FOR INTERPRETING THE DISPERSION CURVES OF WHISTLERS. L.R.O.Storey.
Canad. J. Phys., Vol. 35, No. 9, 1107-22 (Sept., 1957).

This paper considers how the dispersion curves of whistlers may be interpreted to provide information on the distribution of electron density with height in the outer atmosphere. The simpler inverse problem, that of computing the dispersion curve for a given distribution, is considered first. On the assumption of longitudinal propagation in a dipole magnetic field, the dispersion curve is derived in the form of an equation relating the product $tf^{1/2}$ to the frequency f. The equation can be represented by a power series in f, which is useful for estimating departures from the elementary $f^{-1/2}$—t relationship at frequencies where these departures are small. The coefficient of f^n in this series is termed the "dispersion constant of order n". The main problem is now treated, regarding the

above equation as an integral equation determining the distribution of electron density along the path. This integral equation is solved in series, making use of the same power series in f. The dispersion constant of order n is shown to be proportional to the nth moment of the distribution, suitably expressed and weighted. From the values of the moments it is possible to deduce both the initial geomagnetic latitude of the path and the distribution of electron density along it. When the observed dispersion curve is incomplete, so that only the dispersion constants of lower order can be measured, the method yields an approximation to the distribution. A.

BIOLOGY 57/59

578.088.2 : 539.893

THE DESIGN OF AN APPARATUS FOR BIOLOGICAL EXPERIMENTS AT HIGH HYDROSTATIC PRESSURE. See Abstr. 9438

MEDICAL SCIENCE. HUMAN PHYSIOLOGY

61

612.842.32

9995. SPECTRAL SENSITIVITY IN THE PIGEON. D.S.Blough.
J. Opt. Soc. Amer., Vol. 47, No. 9, 827-33 (Sept., 1957).

Measurements of light- and dark-adapted absolute thresholds were obtained from three pigeons at 15 wavelengths ranging from 380 mμ to 700 mμ. Pecking responses caused a stimulus patch to fluctuate in intensity up and down across the pigeon's threshold, and a record of the intensity provided the sensitivity data. The sensitivity of the birds was followed throughout a period of 80 min following a standard pre-exposure to white light. Four complete dark-adaptation curves were obtained from each bird at each wavelength. Spectral sensitivity functions derived from these curves place the photopic maximum at 560-580 mμ, and the scotopic maximum at about 500 mμ. The scotopic function is fitted closely by aphakic human data. The photopic function shows inflections that may be related to similar inflections in corresponding human curves. The functions are quite similar to those found in electrophysiological studies of the pigeon eye. They also correspond rather well to the adsorption spectra of chicken rhodopsin and iodopsin. A.

612.843.32

9996. SOME COMPARISONS AMONG SPECTRAL SENSITIVITY DATA OBTAINED IN DIFFERENT RETINAL LOCATIONS AND WITH TWO SIZES OF FOVEAL STIMULUS. H.G.Sperling and Y.Hsia.
J. Opt. Soc. Amer., Vol. 47, No. 8, 707-13 (Aug., 1957).

Relative cone-sensitivity measurements were made from 420 mμ to 700 mμ in the spectrum using 42 minute and 3 minute diameter test-light fields in the fovea and a 42 minute diameter field at 10° in the periphery. The data were analysed with reference to (a) the suggestion that the humps found in the blue region of the spectrum result from the absorption of macular pigment, (b) changes in the overall shape of the sensitivity function, and (c) the number of humps in the sensitivity function. Two humps were found below 500 mμ in the fovea, one in the orange and possibly two or three between 500 mμ and 580 mμ. Consideration of the possible origin of the humps favoured the conclusion that the humps in the blue region of the spectrum were contributed to by cone activity, since measurements at 10° in the periphery, where there is no pigment, produced an exaggerated hump in the blue below 470 mμ which could only be ascribed to cone activity. Systematic changes in the shape of the functions indicated little change in the long wavelength portion of the curves over the three stimulus conditions, but sizable changes in the relative sensitivity to the short wavelengths. The 10° periphery is increasingly more sensitive than the fovea as wavelengths become shorter than 520 mμ, while the 42' foveal area is appreciably more sensitive than the 3' area to blue wavelengths. A.

612.846

9997. KINEMATICS OF THE EYE. G.Westheimer.
J. Opt. Soc. Amer., Vol. 47, No. 10, 967-74 (Oct., 1957)

A mathematical discussion is presented of eye positions and eye movements in terms of quaternion theory. An eye movement may be regarded as a rotation of the eye about an axis through the centre of rotation. The parameters of the axis of rotation and the extent of the rotation are associated to form a higher complex number, and this leads to the definition of an eye position in terms of the rotation by which it is reached from the primary position. Equations are derived for the parameters of the single rotation equivalent to two successive finite rotations, for Listing's law, for torsional movements, for the angle between the primary horizontal meridian of the eye and the plane of regard, and for the angle between the primary vertical meridian of the eye and the true vertical plane through the fixation line. A.

612.858.7

9998. ON THE FUSION OF SOUNDS REACHING DIFFERENT SENSE ORGANS. D.E.Broadbent and P.Ladefoged.
J. Acoust. Soc. Amer., Vol. 29, No. 6, 708-10 (June, 1957).

A simple place theory of hearing raises the problem that several mixed harmonics may be attributed by the listener to their appropriate fundamental frequencies: the recognition of a vowel sound in the presence of other sounds requires that the formants of the vowel be detected as such and not classified with the other sounds. Thus, the neural message from a particular part of the basilar membrane probably conveys in some way information on the fundamental frequency, to a harmonic of which that part of the membrane is responding. The problem of fusion of sounds on the two ears is merely an extension of the problem of fusion of different frequencies in one ear. It is shown that synthetically produced speech will fuse when the first formant is presented to one ear and the second to the other, but it will not do so if the formants are given different fundamental frequencies. Even when both formants are given to the same ear, the latter condition fails to fuse. A further experiment with sustained formants shows that binaural fusion is not explained by the identity of some of the Fourier components on the two ears. A.

TECHNIQUE. MATERIALS 62/69

66.041

9999. TWO RESISTANCE-TYPE HOT-PRESSING FURNACES FOR LABORATORY USE. R.F.Walker and S.G.Bauer.
Rev. sci. Instrum., Vol. 28, No. 7, 563-8 (July, 1957).

Resistance heating is employed to obtain temperatures up to 3000°C in a graphite tube furnace, and up to 2200°C in a molybdenum tube furnance, both operating from the same controls. Partial control of the atmosphere is accomplished in the former case; the latter furnace may be operated in vacuo, or selected atmospheres. Provision is made for the application of pressure to samples at high temperature. The furnaces have been found to be useful and reliable tools in refractories laboratories, and examples of their application are given. A.

PHOTOGRAPHY 77

778 : 537.22

10 000. ELECTROPHOTOGRAPHY ON PHOTOELECTRETS. V.M.Fridkin.
Kristallografiya, Vol. 2, No. 1, 130-3 (1957). In Russian.

A method is described for producing electrophotographic images on mono- and polycrystalline sulphur and on monocrystalline anthracene. Examples of the images are reproduced. A sensitometric method of investigating photoelectret state is suggested. R.F.S.Hearmon

778.34 : 539.185.08

MEASUREMENT OF NEUTRON SPECTRA BY USE OF NUCLEAR EMULSIONS LOADED WITH Li^6 GLASS SPECKS. See Abstr. 9929

778.37

10 001. TECHNIQUE FOR PHOTOGRAPHING FALLING OBJECTS. J.C.Wiltse, A.Trammell and J.W.Leight.
J appl. Phys., Vol. 28, No. 6, 743-4 (June, 1957).

Water drops were photographed by electronic-flash illumination. The drops fell in front of a camera with open shutter, were detected by a microwave radar system and the resultant pulse triggered the flash tube. The delay time could be adjusted so that the drop was in the centre of the optical field. Drops up to 6 or 7 mm diameter were photographed, their size being compared with a $\frac{5}{32}$ in. ball suspended in the field of view. E.R.Wooding

LIST OF JOURNALS

The following list supplements the List of Journals published with the June number of Volume 60 (1957). Reprints of the List of Journals can be obtained from The Institution of Electrical Engineers, Savoy Place, London, W.C.2, price 2s.0d. post free.

The addresses given are believed to be correct at the date of publication, but no responsibility can be accepted for errors.

Atomkernenergie	Atomkernenergie. Verlag Karl Thiemig, Pilgersheimerstrasse 38, Munich 9.
Chem. and Industr.	Chemistry and Industry. The Society of Chemical Industry, 14 Belgrave Square, London, S.W.1.
Exper. Tech. der Phys.	Experimentelle Technik der Physik. VEB Deutscher Verlag der Wissenschaften, Niederwallstrasse 39, Berlin, W.8. Foreign orders to: Deutsche Buch-Export und -Import, Leninstrasse 16, Leipzig, C.1.
Prace Wrocławskiego Towarzy. nauk B	Prace Wrocławskiego Towarzystwa Naukowego [Travaux de la Société des Sciences et des Lettres de Wrocław]: Seria B. - Wrocław, Poland.
Trudy V.E.I.	Trudy Vsesoyuznogo Elektrotekhnicheskogo Instituta. (Abstracted by the Central Electricity Authority Digest.)

NEW JOURNAL

Periodica polytech., Elect. Engng	Periodica Polytechnica. Electrical Engineering — Elektrotechnik. Postafiók 440, Budapest 62. Vol. 1, No. 1 dated 1957.

ERRATA

Abstr. 1537 (1957) line 3 : for "V.A. Yampol'skiĭ" read "P.A. Yampol'skiĭ".
Abstr. 3374 (1957) line 3 : for "No. 1" read "No. 2".
Abstr. 3377 (1957) line 3 : for "R.M.Chaudri" read "R.M.Chaudhri".
Abstr. 5347 (1957) line 3 : for "C.Guillard" read "C.Guillaud".
Abstr. 5788 (1957) line 1 : insert "I. The solution when the restoring force is expressed as $F = \psi$."
Abstr. 6614 (1957) line 12: for "Abstr. 5851" read "Abstr. 5651".
Abstr. 7138 (1957) line 13: for "nitrogen" read "oxygen".
Abstr. 7232 (1957) line 4 : for "Abstr. 6964/1051" read "Abstr. 6964/1951".
Abstr. 8303 (1957) line 3 : for "B.K.Vaĭnstein" read "B.K.Vaĭnshteĭn".
Abstr. 8378 (1957) line 7 : for "$M = M_0$" read "$M = \mathcal{M}M_0$".
Abstr. 8684 (1957) line 3 : for "235-45" read "234-44".
Abstr. 9254 (1957) line 7 : for "$(\overline{Z} > 5)$" read "$(Z > 5)$.
Abstr. 9342 (1957) line 8 : for "curves" read "curve".
Abstr. 9378 (1957) line 7 : insert "multiply-charged" before "products"

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